Meter-Testing Methods and Apparatus Employed by a Western Company—*Tests to Determine the Heating of High Voltage Underground Cables and Other Engineering Articles Dealing with Station and Operating Practice*

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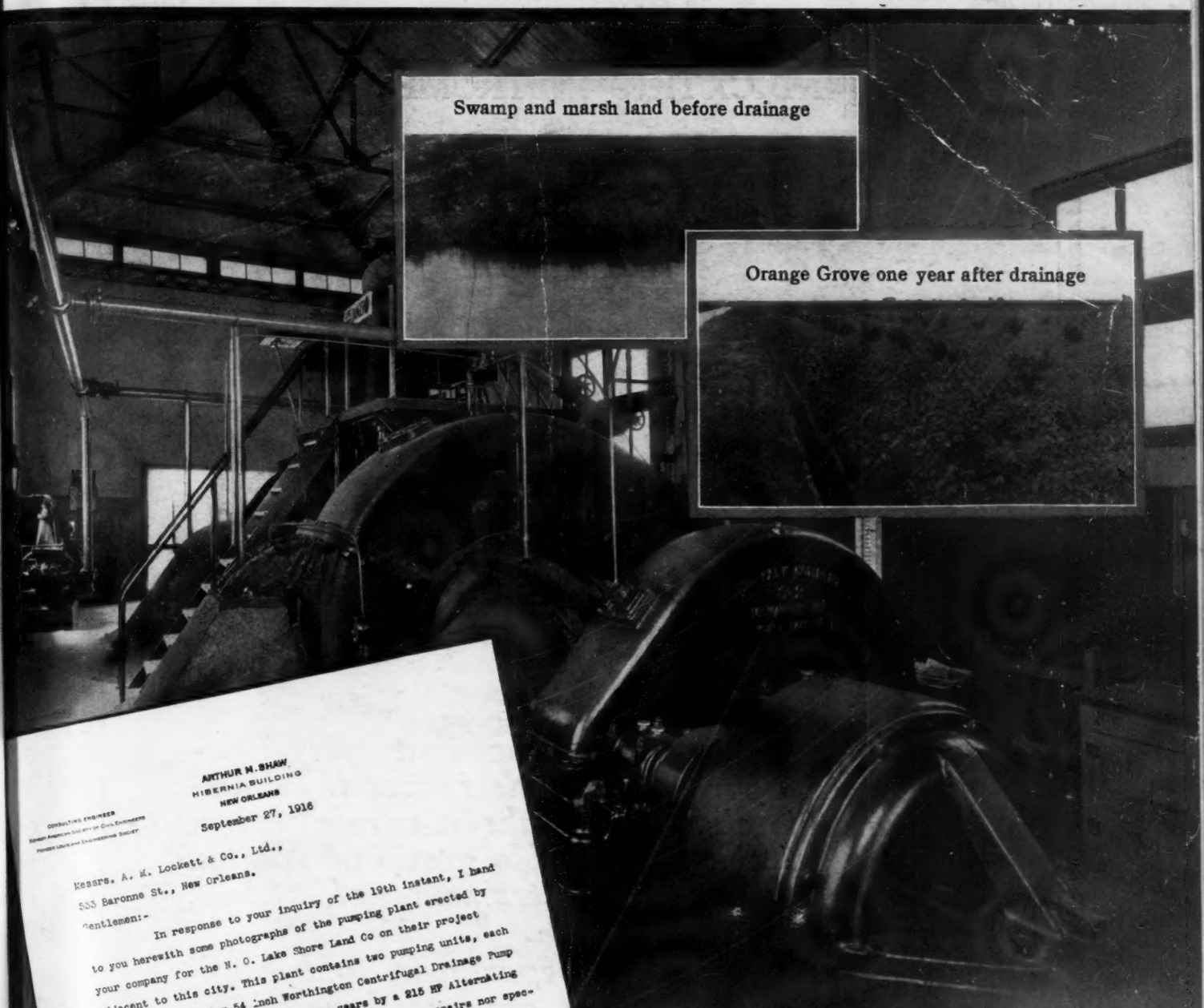
Electrical World

New York, November 11, 1916 McGraw Publishing Co., Inc. Vol. 68, No. 20 10c a copy

Swamp and marsh land before drainage

Orange Grove one year after drainage



ARTHUR H. SHAW
HIBERNIA BUILDING
NEW ORLEANS

CONSULTING ENGINEER
Member American Society of Civil Engineers
Member Louisiana Engineering Society

September 27, 1916

Messrs. A. M. Lockett & Co., Ltd.,
533 Baronne St., New Orleans.

Gentlemen:-

In response to your inquiry of the 19th instant, I hand to you herewith some photographs of the pumping plant erected by your company for the N. O. Lake Shore Land Co on their project adjacent to this city. This plant contains two pumping units, each consisting of a 48 x 54 inch Worthington Centrifugal Drainage Pump driven through Herringbone reduction gears by a 215 HP Alternating Current Motor. These pumps have never required any repairs nor special attention and have given excellent service ever since their installation three years ago. The acceptance tests showed the plant to be well above the guarantees of capacity and efficiency.

I consider the Worthington Drainage Pumps especially well adapted to conditions encountered in land reclamation projects in this section.

Yours very truly,
A. H. Shaw
Engineer N.O.Lake Shore Land Co.

What Electrically Driven Worthington Pumps have done in Drainage Projects

The project illustrated was the drainage of 7,000 acres of marsh land practically at sea level.

These Worthington pumps were sold under guarantee that each would deliver 76,000 gallons per minute against an actual lift on the two sides of the plant of 6'.

In actual service they have exceeded the guarantee in both capacity and lift.

We shall be glad to submit full data on many successful Worthington equipped drainage projects.

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WESTON ELECTRICAL INSTRUMENT CO.
NEWARK, N.J., U.S.A.

Model 167
Single-Phase Wattmeter
(Complete Group described in Catalog 16.)

possess superiority so radical that every Consulting or Operating Engineer owes it to himself and his clients to make a careful investigation of this remarkable group of Weston Instruments, and of instruments offered in competition.

The Weston Sales Department and Engineering Staff will assist any members of the profession or prospective users to investigate this important matter.

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Settling Rate Cases Economically

WHEN the public service commissions began to take jurisdiction over the utilities only a comparatively few cases of complaint were settled informally. The informal method of settling differences was regarded as desirable under some circumstances, but as a rule it was confined to the less important matters. If a case was of no great importance it could be disposed of at a simple conference between the complaining consumer and representatives of the company and the commission. But if it involved large questions it had to be considered with the elaborate formality which the complex machinery of the law provided; that is to say, there had to be public hearings with witnesses and counsel engaging in prolonged testimony and cross-examination. Then the evidence had to be sifted and examined and the engineering and accounting representatives of both commission and company undertook exhaustive steps that frequently extended into detailed valuation. The result was appalling costs which, as we have often pointed out, are essential parts of the costs of operation that the public must pay. In many cases that was economic waste. It is highly encouraging that so important a case as that of the New York Edison Company is now regarded as susceptible of informal settlement. The company is spared the burden, the uncertainty and the expense of valuation and the community receives a rate reduction without delay.

Costs Chasing Earnings

NO central station manager of forethought will consider rate reductions at this time without also looking with undisguised misgivings at the rising cost of coal. The New York Edison Company stipulates that it may have to reconsider its acceptance of a reduced rate arrangement because of the grave uncertainties with which the future of operating costs is clouded, and in so doing it calls attention in a necessary way to an uncontrollable element which the future holds. It is not to be expected that the spectacular prices for coal which are quoted now will hold long. Under normal conditions the average central station is too well managed to be caught short of this vital commodity. But these are not normal conditions, and the deficiency in coal cars, the slow handling of freight and the enormous and unsatisfied industrial demand make it impossible for companies to anticipate their requirements as far in advance as they usually do. Furthermore, they have had to meet heavily-increased prices. The operator looks at his load diagram and comforts his heart with the thought of a 15 per cent increase in gross earnings. He cannot afford to overlook the impressive fact that his costs are mounting much more rapidly than his earnings. If costs overtake earnings the note of jubilation over the favorable record of gross earnings will be sobered perceptibly.

Electric Power in a Steel Mill

THE operation of steel rolls is a notoriously difficult mechanical feat of modern industry owing to the sudden and tremendous variations of the load. It is not many years ago that such work was supposed to be altogether beyond the electric drive, but the account given by Mr. Jefferies, electrical engineer of the Steel Company of Canada, of the motor-driven rolls in the Hamilton (Ont.) works gives a most graphic idea of the successful way in which the difficulties have been met. The reversing rolls in this instance are driven by two shunt-wound interpole motors, each of 3000-hp., continuous rating. These in turn are fed from two 600-volt direct-current generators mounted as a pair on the same shaft with a 2200-volt 1800-hp. three-phase motor and a 50-ton flywheel. The effectiveness of this flywheel system in smoothing out the immense variations of load is well shown in the curves accompanying the article. During a brief period in reversal the rotative energy of the mill motors is returned to the line, at a rather low efficiency to be sure, but in quantity enough to make a very perceptible difference in the total input. At times the mill motor has to accelerate from 0 to full speed in one and a half seconds. The motor curves show that the maximum input is very near to 3000 kw. and the time taken from full load in one direction to full load in the other is often scarcely ten seconds. Yet for this great variation the input on the motor-generator set, thanks to the flywheel, varies by a scant 250 kw. The energy consumption per ton roll under good operating conditions amounts to a little less than 20 kw.-hr. per ton, sufficient evidence that the electric drive is both technically and economically sound.

Interpreting Power Plant Records

CONCERNING the necessity for accurate operating records in a large power plant much has been written. The average large station manager or owner believes that his operating force should keep information and data on plant performance, but is too often content when certain that such routine duty is performed. The conditions are even worse in the small

industrial power plant, for here the duties of the manager are usually far removed from details of operation, so that in the majority of cases he cannot show itemized statements of the cost of operation for definite or regular periods. Owing to the prevalence of this condition, the central station has been able to make its large inroads into the industrial field once chiefly occupied by the isolated plant. In some instances accurate cost records would have readily illustrated the folly of shutting down an economical power plant still capable of giving efficient service for a number of years, and equally as readily show when inadequate isolated plants that are thought to be operating efficiently can no longer compete with central station service on a purely unit-cost basis.

Power plant records should bear the same important function to the management of an industrial business, as the records that show details of production and expense in any other manufacturing department. The most prevalent purpose in keeping operating records is to determine the efficiency of the plant from the standpoint of machine performance, and they consist of coal data, labor items, temperature, pressure and other routine readings. There is no relation between the items and their pecuniary value, so that their significance to the business man is largely that the chief engineer is on the job and watching conditions. Intelligent, carefully arranged and interpreted plant records are a gold mine of information, for besides showing where money must be spent they show where money may be saved. Whatever the nature of a business the item of power cost is sufficiently important to be a determining factor in the total cost of a finished product, and for this reason should be given as much attention as the accounting of any other manufacturing expense.

Heating of Underground Cables

ONE of the difficulties of the operating engineer in a large city distributing system is to keep all cables cool under severe conditions of load, especially in summer. The durability and permanence of a cable in alternating-current service depends, among other things, upon the temperature of its hottest spot. If this temperature can be kept from exceeding a certain critical value, determined by the nature of the insulating material, the cable is not likely to fail from current overloads. Henry A. Cozzens, Jr., gives some interesting records in his article on page 953 of current and sheath temperatures on two feeder cables, one of which actually failed during the observation period. The current records appear to be plotted from half-hour observations taken at a substation connected with the feeder, and the temperature records are described as having been taken by a recording thermometer on the cable sheath in a manhole. The cable whose records appear in Fig. 1 was a 2400-volt paper-lead cable, with 3/32-in. insulation. The cable referred to in Fig. 2 was a 13,200-volt paper-lead cable, with 7/32-in. insulation.

It is interesting to observe that in both records the temperature indications on the lead sheath lag behind the changes in load, but the lag is markedly greater on the higher-tension cable with its thicker insulation. This may be accounted for by considering that the thermal resistance between sheath and conductor was much the greater in the high-tension cable, whereas the thermal resistance between sheath and air was probably nearly the same for both. The hottest-spot internal temperature would in that case be greater in the higher-tension cable. The temperature indications would not only be smaller, but also more sluggish outside the insulator of greater mass. Such comparative current-temperature records should be distinctly serviceable, even allowing for different thermal conditions in different manholes.

Incidentally, Fig. 1 of the article shows what may happen when a factory suddenly throws a considerable load on the system at 10 o'clock on a Saturday evening without giving notice. The temperature in the feeder may be considerably above normal before the switchboard operator notices the excessive current.

Centrifugal Pumps for Boiler Feed

IN another column the oft-mooted question of centrifugal as against piston pumps for boiler-feed work is discussed. The centrifugal pump is a machine which has only been well developed in very recent years. In principle it is beautifully simple and effective, and if well designed is so in practice as well, but as the author shows, it is a machine requiring precise design to suit the conditions for which it is to be used, and most of the failures which have been charged against it have been due to the neglect of this fundamental fact. It was formerly considered impracticable to get good efficiency from a centrifugal pump at anything except low heads. In small sizes, say below 200 gal. per minute, it is very inefficient so that small centrifugal pumps are often undesirable. On the other hand, with large and well-designed pumps the efficiency is excellent, especially if the pump is run near to full load. Its best conditions for efficiency are unquestionably rather moderate head and large and steady output, and under these conditions it does astonishingly good work. Even at considerable heads satisfactory results may be obtained by working pumps in tandem, the flow from the impeller of the first being delivered to the suction of the second and so on. From the figures given it appears that a head of about 100 ft. can be dealt with at each stage, so that for boiler-feed work four or more stages would not infrequently be required. Included in the article are some very useful diagrams and data for the design of feed pumps upon the system under review.

The centrifugal pump is so convenient and compact, and in fairly large sizes so economical in first cost, space, and operating cost, that it is rather attractive to the designing engineer. The main point is that it must be used for feed water or any other purpose with a full realization that its best work is done within comparatively narrow limits, and therefore it must be carefully planned to meet the exigencies of the particular job on which it is to be employed. It is not the only case in

engineering of very valuable apparatus which, to develop its good qualities, must be used under somewhat rigorous limitations. The steam turbine, itself the mainstay of modern power plants, for instance, is notoriously sensitive to vacuum conditions with respect to its economy about operation, but this constitutes an objection against its use only to that curious type of mind which insists on universal applicability to every purpose and condition irrespective of the task immediately in hand.

Rationalization of the Magnetic Units

EVER since the creation of the practical volt-ampere-ohm system of electric units by the British Association, as a workshop set of decimal derivatives from the fundamental c.g.s. system, electrical workers have labored under two disadvantages: first, the artificial barrier imposed by the magnitudes of these units between the practical system and the parent scientific system, and, second, the irrationality of both systems. Various expedients have been suggested for rationalizing the existing units, as was pointed out in a recent issue through the interesting article on this subject by Dr. Dellinger. They nearly all propose to change the Magnetic Ohm's law equation $\phi = 4\pi NI/R$ so as to eliminate the 4π in the numerator. Dr. Dellinger proposes that the ampere-turn shall be the unit of mmf., instead of the gilbert, and that the reluctance unit shall be enlarged in the ratio 1.257, to suit. We should then keep the same unit of flux and flux density as at present. In other words, the gilbert would be superseded and replaced by the ampere turn. The oersted would be replaced by a new and larger oersted; while the maxwell and gauss should stay. This plan was originally proposed by Steinmetz; but the new Dellinger proposals go deeper, and include corresponding changes in the fundamental magnetic equations.

The proposed Dellinger units are part of a larger scheme of electromagnetic units based on the "volt, ampere, centimeter and second." Such a system would have the advantage of being a complete self-contained scientific or absolute system; but would have the disadvantage of being divorced from the c.g.s. system, on which the other modern sciences are mainly based. It is, therefore, a matter for debate whether the change, on the whole, would be advantageous or not. In any case, such changes either of the magnetic rationalization or of the larger fundamental system, can only be made effective by international agreement. It would be very unfortunate for any country, or for any particular group of workers in a country, to adopt in advance such proposals however valuable; owing to the dissensions and probable misunderstandings thereby entailed in the electrical engineering literature of the world.

Meter-Testing Methods

UNDER the operating conditions of central station distributing systems there are two classes of watt-hour meter tests recognized and requisite, namely, shop tests and field tests. In shop tests, the watt-hour meter to be tested can be placed conveniently on a specially prepared testing table, in the vicinity of carefully calibrated standard instruments, and tested for as long a period as may be necessary for revealing the condition of the meter or for making readjustments of its constant. In "field tests," which, by the way, are commonly conducted in basements and cellars, the watt-hour meter to be tested is fixed, often in a corner where access to it is restricted, and the testing instruments have to be brought to it by the tester or inspector, and may have to be read under awkward and inconvenient conditions. The needs and limitations of these two classes of tests are therefore distinct, and it is important to keep the distinction clearly in mind.

The article this week by Otto A. Knopp on the results of meter-testing experience of the Pacific Gas & Electric Company is of particular interest in regard to the types of instrument developed for the two classes of tests above mentioned. In the field tests portability, simplicity and reliability are of the first importance. An adjustable resistance load of 1-kw. dissipation has been reached after successive steps of improvement and redesign. By this means the correction factor for the meter is determined through a revolution count during a period of time which may be called a centihour. The decimalization of the hour is a marked feature of the technique in both classes of tests. Since all the meters record in watt-hours, or decimal multiples thereof, there is a manifest disadvantage in testing them with time meters rated in sixtieths or sixtieth-squareds of an hour, the hoary old Babylonian incubus. In order to derive watt-hour correction factors with the maximum of reliability and minimum of cerebration or arithmetic, millihour meters, both fixed and portable, as described in the article, are a great advantage.

The Coming Issues

IN the engineering number of the ELECTRICAL WORLD for November, the issue for next week, a leading article will treat of recent progress in the design and construction of high-tension equipment. The theory and calculation of the split-phase electromagnet will also be discussed in a second important article, and there will be the usual departments for the operating and commercial man. In the commercial number of the following week, issued under date of Nov. 25, it is planned to continue the series of articles on export trade in electrical apparatus, installments of which have appeared in recent numbers. Besides features of broad commercial policy, there will be articles on electrical applications for power and lighting and the regular departments. The November number of ELECTRICAL MERCHANDISING, the new monthly magazine which extends to the electrical trade the editorial service of the ELECTRICAL WORLD, will be issued on the fifteenth of the month.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

RAIN NEEDED IN NORTHWEST

Extended Dry Spell Puts Heavy Load on Steam Stand-by Stations

While the steam stations are wondering what the coal situation will come to hydroelectric operators in the Northwest are having their troubles owing to the continued dry spell. For weeks no rain has fallen, and the loads on the steam plants are beginning to tax their capacity.

Seattle's long-continued dry spell, according to the latest reports, has reached the point where its power and lighting systems and street railways may be seriously hampered in service. Even now the Puget Sound Traction, Light & Power Company and the municipal lighting system are using their steam auxiliary plants to their utmost capacity in an effort to conserve the water supply for the continued operation of their power plants. Officials predict that if rain does not fall within ten days or two weeks the hydroelectric power plants will not develop enough power to maintain their present service on street railways. The traction company is generating power at its steam auxiliary at Georgetown, while the city emergency plant on Lake Union is furnishing more than half the power used.

COAL SHORTAGE BEING RELIEVED

Doubtful, However, if Complete Relief Can Be Afforded for Some Time

Dispatches from Washington on Wednesday reported statements from the Interstate Commerce Commission members to the effect that already certain sections of the country are experiencing relief from the present coal shortage. As a result of the co-operation of the railroads with the commission, more coal, it is understood, is being shipped. The situation is described as still very bad, however, and it is doubtful if complete relief can be afforded at any time soon.

Reports received by the commission are that the railroads are hauling more coal than heretofore because they have succeeded in getting shippers to unload cars more promptly and are making more mileage a day with the cars they have. In consequence deliveries are more prompt and the stocks of dealers are rapidly resuming their normal size.

The commission received a report that the New York, New Haven and Hartford Railroad Company had established an embargo on certain classes of freight but had excepted coal. The officials said that they were confident that this action will afford relief, since it will permit greater shipments over the New Haven lines. They had no information about whether other railroads expect to follow the lead of the New Haven and establish similar embargoes.

The Interstate Commerce Commission is without authority to order a railroad to establish an embargo. The railroads do not even have to notify the commission that they have taken such action, although it is customary for them to do so.

The commission is continuing its informal efforts to relieve the car shortage situation, in addition to the hearings which are being conducted by Commissioner Charles C. McChord at Louisville, Ky., ordered for the same purpose. The formal hearings at Louisville were started on Wednesday.

Representatives of industrial plants, public service corporations, and commercial organizations were the first witnesses to be heard in connection with the formal investigation.

Among the witnesses who appeared Wednesday was D. F. Hurd of the Chamber of Commerce of Cleveland. He said that many industrial and public service plants throughout a large part of the North and Northwest soon would be forced to suspend operation unless embargoes upon the movement of their cars to foreign lines were lifted by Southern coal carrying roads. These embargoes are the result of the refusal of Northern and Eastern lines to return other cars, when empty, according to statements made by officials of the Southern roads involved.

In the Kentucky Ohio region the coal shortage is the uppermost subject at this time and central station operators and manufacturers alike are hoping that something will result to help the situation from the Interstate Commerce Commission inquiry. The Louisville & Nashville railroad has declared an embargo on coal shipments to certain sections north of its line and this, for the time being at least, will insure a better supply to Louisville and other points on the Louisville & Nashville. However the pinch is keeping many a small plant on the anxious seat. The Carlisle (Ky.) Electric Light & Power Company found it necessary to discontinue day service for a time, running in the evenings on coal obtained from local retailers. Later a car of coal was delivered and full time service was resumed in the expectation that more coal would be available after that was gone.

LIBERTY LIGHTING PLANS FORMED

President Wilson to Be Present at the Ceremony of Dedication on Dec. 2

Definite plans have been made to inaugurate the permanent flood-lighting of the Statue of Liberty on Saturday night, Dec. 2, as a tribute to the national celebration of America's Electrical Week which begins on that day.

President Wilson and a distinguished gathering of governors, cabinet officials, ambassadors and civic and industrial leaders will attend the ceremony. Secretary Daniels has assigned a battleship fleet to a week-end in New York Harbor for the occasion. New York City will officially participate through a committee to be named by Mayor Mitchel.

The active work of laying the transmission cable from the New Jersey shore to Bedloe's Island is under way. Instead of an isolated plant installation, the statue will be illuminated by central station service, the Public Service Electric Company furnishing the energy.

More reflectors, it is stated by those under whose directions the plans have been laid, will be used on the statue than have been required to flood-light any building or palace to date. Because of the pressure

for time and the difficulties of getting material, engineers from the General Electric Company and Governor's Island two weeks ago set about assembling this vast equipment. This apparatus is now at Bedloe's Island. The installation has the personal attention of W. D'Arcy Ryan, who installed the famous flood-lighting system at the Panama-Pacific International Exposition.

AMERICA'S ELECTRICAL WEEK PLANS WELL SHAPED

Reports of Activities of Local Committees Show That Great Emphasis Is Being Laid on Electrical Shows

With the date set for the celebration of America's Electrical Week but three weeks away practically all arrangements have been completed and now there remains to be considered only a few of the minor details. This year it is evident from the reports of the local committees to the Society for Electrical Development that the greatest emphasis will be laid on an electric show and on the "shop-early" movement. Education of the public will be the keynote of the 1916 celebration.

The following list gives the names of those cities which will stage an electrical show during the week, according to reports received up to the first of the week: Aberdeen, Wash.; Atlanta, Ga.; Birmingham, Ala.; Charlotte, N. C.; Cincinnati, Ohio; Des Moines, Iowa; Detroit, Mich.; Duluth, Minn.; Fort Wayne, Ind.; Louisville, Ky.; Milwaukee, Wis.; Oklahoma City, Okla.; Pittsfield, Mass.; Sandusky, Ohio; San Francisco, Cal.; Seattle, Wash.; Spokane, Wash.; Springfield, Ill.; Springfield, Mo.; Syracuse, N. Y.; Toledo, Ohio; Trenton, N. J.; Tulsa, Okla.; Wichita, Kan.

Already the ELECTRICAL WORLD has reported plans for a number of cities. Reports from additional cities follow:

An electric bazaar occupying the ground floor of a business building will feature the Grays Harbor Railway & Light Company's program for the week at Aberdeen, Wash. An electric sign will be displayed outside the bazaar and electrically driven instruments will provide music for the visitors. A drive on house wiring and special prices on appliances will be worked in connection with the bazaar. A slogan campaign is proposed in co-operation with the Chamber of Commerce. School essay contests, flood-lighting of staues and main buildings, special illumination of the main streets and elaborate advertising are included in the company's plans.

The first shipment of lights to put Waycross, Ga., in gala attire for America's Electrical Week arrived on Nov. 1. Five thousand vari-colored lights of all sizes will be used in decorating the main street for the big advertising street dance which will feature the celebration. The committee is canvassing every merchant and business house in the city and practically without exception, every business interest in Waycross will be represented by costumed dancers.

F. H. Woodward of the Great Western Power Company includes in his plans for the week at Oakland, Cal., the co-operation of the Oakland Traction Company, which will carry window cards and equip a flat car which will be run throughout outlying districts, bearing electric signs and directing attention to America's Electrical Week. The Oakland Traction Company will install a co-operative exhibit of participation in electrical pages, besides publishing the "Aladdin" design and using the poster in its bulletins. Prizes will be offered for essays by the children who will visit the central stations.

W. E. Clement of the New Orleans Railway & Light Company advises that the leading monuments and public buildings of New Orleans will be permanently flood-lighted during the week. The committee has enlisted the active co-operation of all department stores and other mercantile concerns in a plan for illuminating and decorating the main thoroughfares of the city. Many of the plans for the week, such as school participation, special advertising, luncheons and exhibits are included in the program.

W. E. Coman of the Northwestern Electric Company, Portland, Ore., announces that plans have been made for a comprehensive program and that sub-committees have been appointed to handle billposting, the window displays, a window display contest, lectures before civic clubs and organizations, illumination of the Willamette Bridges, social electric signs, downtown decorations and extensive newspaper advertising.

A. S. M. E. ANNUAL MEETING

Public Hearing on Boiler Code to Follow on Dec. 8 in New York City

The anual meeting of the American Society of Mechanical Engineers will be held at the Engineering Societies' Building, New York City, on Dec. 5, 6, 7 and 8. Immediately following the meeting there will be a public hearing on the boiler code on Friday, Dec. 8, at 2 p. m., to continue as long as the occasion requires.

Following is the tentative program for the society's meeting of interest to electrical men:

Tuesday Evening, December 5

President's address on the "Relation of Education to Engineering," by Dr. D. S. Jacobus. This will be followed by the regular routine and an informal a reception to the president, president-elect, ladies, members and guests.

Wednesday Morning, December 6

OPENING SESSION

Business Meeting.

Following the regular business of this session, there will be memorial exercises in honor of the memory of John E. Sweet, past-president, honorary member and founder of the society.

MISCELLANEOUS SESSION

"The Proportioning of Surface Condensers," by George A. Orrok.

"The Testing of House-Heating Boilers," by L. P. Breckenridge and D. B. Prentice.

"Water for Steam Boilers—Its Significance and Treatment," by Arthur C. Scott and J. R. Bailey.

INDUSTRIAL SAFETY SESSION

Under the auspices of the Sub-Committee on Protection of Industrial Workers

Report on safety standards for the operation of cranes.

Wednesday Afternoon

MISCELLANEOUS SESSION

"The Utilization of Waste Heat for Steam Generating Purposes," by Arthur D. Pratt.

"Graphic Methods of Analysis in the Design and Operation of Steam Power Plants," by R. J. S. Pigott.

"Power Plant Efficiency," by Victor J. Azbe.

Thursday Morning, December 7

VALUATION SESSION

It is expected that this session will continue both morning and afternoon.

"Accurate Appraisals by Short Methods," by J. G. Morse.

"Productive Capacity a Measure of Value of an Industrial Property," by H. L. Gantt.

Other authors will present papers on the relation between industrial valuation and utility valuation; on the interest of the public in valuation; on the relation between perpetual inventory value and appraisal value, and on amortization and depreciation.

NEW YORK EDISON RATE CASE SETTLED WITHOUT VALUATION

Representatives of the Company, the City and the Public Service Commission Agree to Early Reduction and Avoidance of Lengthy Proceedings

At a hearing before the New York Public Service Commission, First District, J. W. Lieb, vice-president of the New York Edison Company, announced that as the result of conferences between the company, Public Service Commissioner Hayward and City Chamberlain Maltbie, representing the Mayor, that company as well as the United Electric Light & Power Company will make a reduction in rates in Manhattan and the Bronx. The present maximum general rate of 8 cents per kilowatt-hour is to be reduced to 7.5 cents per kilowatt-hour, exclusive of lamps, commencing Jan. 1, 1917, and continuing until July 1, 1917; a further reduction to 7 cents per kilowatt-hour, exclusive of lamps, is to be made on July 1, 1917, if no unforeseen adverse conditions are experienced. This is to apply also to the portions of the Bronx where the two companies now have a 10-cent rate. It is estimated that the reduction to 7.5 cents per kilowatt-hour will result in a saving to consumers of $750,000 for six months on rates of the New York Edison Company alone. Should this saving not be effected, however, the company agrees to apply the difference between $750,000 and the amount of the reduction to a further reduction in rates below the maximum.

REDUCTION SHOULD APPROXIMATE $1,750,000 FOR SIX MONTHS

It is calculated by the commission that the reduction for the entire year should approximate for both companies $1,750,000. As it is anticipated that the cost of the New York Edison Company of operation for 1917 will increase considerably, the net reduction in revenues will be much greater than the saving to consumers.

It was at a meeting on Oct. 3, 1916, that J. W. Lieb, Jr., vice-president and general manager, suggested that the commission confer with the company's representatives and City Chamberlain Maltbie to ascertain whether the rates could not be settled without the lengthy proceedings necessary in appraisal. Acting upon this suggestion, Chairman Straus appointed Commissioner Hayward to represent the commission, the company appointed Mr. Lieb, and the city was represented by Dr. Maltbie. A number of conferences followed.

On Nov. 2 Mr. Lieb appeared before Chairman Straus and Commissioner Hayward, and stated that the company would carry out a plan of settlement by making reductions. He said in part:

MR. LIEB'S STATEMENT

"We would again call attention to the uncertainties of the present situation involving unhealthy and overstimulated business conditions resulting in abnormally increased output, the serious situation in the coal market with rapidly advancing prices, a large increase in cost being inevitable, and on the basis of present prices the increase will probably reach at least $1,000,000 a year in excess of corresponding costs in 1915, and the uncertainties of the labor situation, requiring continual increases in the payroll due to increased rates of pay and shorter working hours, all of which have the effect of making most hazardous any forecast as to the company's future earnings.

"Under such critical circumstances, requiring the constant vigilance of the company's executive, commercial and operating staffs, we should not be called upon to make the additional expenditures in time and money that would be necessary to undertake a complete inventory and appraisal of the company's property.

"We believe that the public would reap a larger benefit if the company were to apply the labor and money involved toward expanding its business and developing new applications for its service.

"Confronted with the possibility of great impairment in its revenues, due to (*a*) the termination of the European war, (*b*) the increase in the price of coal and of all other materials and supplies entering into the production and distribution of electrical energy, (*c*) the imperative necessity of meeting, regardless of the increase in the cost of labor, the requirements which the public may make upon it, and (*d*) the possibility of the adoption of a plan of daylight conservation, the company feels that it should not be required to commit itself at this time to a modification of its rates resulting in a large saving to the public, except upon conditions which will enable it, after the lapse of a given period, to restore the present rates in case the circumstances become such that the company feels justified in so doing.

"In case the justification for restoring the present rates and the conditions of lamp service is not apparent also to the commission and the representative of the Mayor, the case can be reopened at once and the present status restored. It is not conceivable—unless there is a radical change in the complexion of affairs—that the company would revoke a concession which, under all conditions, it may now feel justified in making. On the other hand, if conditions do arise which justify such action, the company should be in a position to act promptly.

RELIED ON THREE-YEAR ORDER

"The company when it accepted the commission's original order in cases Nos. 1395 and 1492, in accordance with which it put into effect on May 1, 1915, a new rate schedule which has resulted in a net saving to the public of approximately $2,100,000 a year, did so with the understanding that it abandoned the right of appeal as against the terms of the order and that the order would remain in effect for three years, from May 1, 1915, or until May 1, 1918.

"Now, at the expiration of only one-half the period specified in the order, we are called upon, at a time when business conditions are seriously disturbed, to submit to its reconsideration, with a view to requiring the company to make further sacrifices and put into effect a new rate schedule involving a large further reduction in its revenues.

"By fixing, in the order made March 16, 1915, a specified term during which it was to remain in full force and effect, the commission exercised the power conferred upon it by Section 72 of the public service commission law, and elected to follow one of the alternative methods provided by Section 23 of Article 1 of that law, and it is respectfully submitted that it is not now at liberty to reverse its action.

"Even if it were admitted, for the sake of the argument, that there might be some doubt as to the power of the commission to fix a rate to obtain for a given period without recourse, or to suspend the exercise of such discretionary powers as the commission may possess, the order was the outcome of an adjustment reached with the company, under which the company in turn gave up its statutory rights and acquiesced in a large immediate reduction in revenue in behalf of the public."

Mr. Lieb then called attention to the fact that on May 2, 1913, the commission adopted an order of discontinuance in case No. 1610 (in the complaint of A. Herrmann et al. against the Newtown Gas Company). In

that case a maximum rate of 95 cents per 1000 cu. ft. was made for gas for the period of one year ended May 1, 1914, without prejudice to the rights of the complainants and the company after that date. On April 23, 1914, the Newtown company notified consumers that the rate after May 1, 1914, would be $1.

REASONS FOR SIX MONTHS' PERIOD

Mr. Lieb outlined the offer for reduction of the Edison company rates, adding:

"It is understood that the complainants and the company in accepting the above agreement do so without prejudice to their rights after July 1, 1917. The period fixed in the order in case No. 1610 was one year. The conditions at the time that order was issued were normal and the likelihood of any serious contingency arising during the period was too remote for serious consideration. The foregoing proposition differs from the Newtown case only in respect of the period, which is fixed at six months, from Jan. 1, 1917. The reason for this is obvious. Conditions now are without precedent or parallel. It is impossible to forecast what the company may have to pay within the next eight months for coal or other materials and supplies. The prices may increase beyond any figures which can, at present, be foreseen, the cost of coal at the mines having already increased 300 per cent. Conditions may become such that the premium to be paid for labor in order to continue operating may be without any precedent in history, and it is in order to guard against these and other possible contingencies that the period has been fixed at six months."

PRAISE FOR THE COMPANY

Commissioner Hayward said that whatever might be the general view, he personally felt that it was a wonderful step in the right direction, and that while fair to the company had resulted in great benefit to the public. He also took the opportunity to say that in his entire official life and entire private practice of the law he had never had any negotiations with gentlemen who were apparently more actuated by a desire to meet fairly and squarely, put all the facts before the commission or before the conferees than had been Mr. Williams and Mr. Lieb.

Dr. Maltbie, on behalf of Mayor Mitchel, stipulated that the new rate schedules should be open to inspection for one month before they were to take effect.

P. A. McManus, speaking for some consumers, urged a delay and a valuation. Because of his request an adjournment for one week was taken.

VALUATION NOT EXACT

Chairman Straus, however, spoke of the generous consideration on the part of the company of the interest of the public in coming forward and making a reduction, and declared that it should be met in a proper spirit of appreciation. Adding that there was nothing in the way of later valuation, Chairman Straus said that such a method is a long and tedious proceeding "which may run over, not months but years, and it is not such an exact science—it has not yet been developed —that you can predicate exact results from it."

Dr. Maltbie said that the plan was perfected practically without expense to the commission and the city, that it would go into effect immediately without involving the year to two years that might be expected if an appraisal were made. "If one keeps in mind also the fact that the present is a time of high prices and fluctuations," he added, "and that these matters would enter into an appraisal, I am sure that he would come to the conclusion that it is wise to accept this proposition."

DEFERRED CONSTRUCTION

Cost of Building Materials and Equipment and Labor Shortage Responsible

Prices of building material and equipment are so high and labor is so scarce even at wages much greater than ever before paid, that much of the improvement and development work which light and power companies had expected to start this year has been deferred until better conditions obtain. Practically only that construction which has been absolutely necessary has been contracted for and the plans carried out. Even where utilities have decided to accept conditions as they were and go ahead with plans already formed it has been found in many cases that no deliveries could be had even at the high prices.

As indications of the general condition that the industry has had to face are the following paragraphs from the Detroit Edison *Synchroscope:*

"The Detroit Edison Company's plans for progress have suffered, like those of most other concerns, from the prevailing high costs of materials and the present short supply of labor, skilled and unskilled, in the building trades. All the buildings in hand for the company, such as the Willis Avenue substation and the heating plant at Willis Avenue, the Second Avenue and Highland Park substation extensions, and the No. 3 unit for Connors Creek power plant, have been badly delayed, and high prices have carried the costs away beyond the estimates. Much of the work which it was proposed to do during the coming winter and next year will be postponed, because all prices at the present time are much above normal, and no contractor will guarantee either prompt delivery of materials or prompt completion of work. The officers and directors of the company have decided that only such work will be undertaken as is immediately necessary for the maintenance of service, and unavoidable extensions. And the same policy will have to be followed in 1917, unless conditions change.

"One of the projects which have been definitely set back is that of the service building. The concrete foundations will be put in by the company's men whenever it becomes convenient to do so, but the building of the superstructure has been definitely set back for two years, and the lease of the upper three floors of the David Whitney Building has been extended for the same length of time.

"Almost every department has suffered this year from delays in getting material, and has its own story of trouble to tell. But all will be interested to know that every contract for the Connors Creek building was from four months to six months behind schedule. Even the steam turbine No. 3, which should have been shipped in June, is now promised for December shipment. Every contractor says he cannot get material, and most of them say they cannot get men. In case of the turbine, the tremendous demand for large steel forgings and the shortage of forge capacity has been the principal difficulty.

"One undertaking which cannot be stopped or set back is the addition of the 45,000-kw. turbine to the generating capacity. This turbine is to be installed at Connors Creek instead of in the first section of a new house at Delray. The reason why this change was made is a long story, and conduit and cable and switching problems make a large part of the story. Contracts have been awarded for steel work, flues, stack and boilers for two sections of the building at Connors Creek, the 45,000-kw. turbine being equivalent to two 20,000-kw. units. The prices at which these contracts have been placed are higher than those paid for the work now being completed by 50 per cent to 90 per cent. Only

the necessity of fulfilling our contracts and serving our public, and the hope that next year will bring a reasonable change, warrants us in continuing construction under such conditions."

CONDEMNATION PROCEEDINGS MAY START IN SEATTLE

Bill Expected to Be Introduced in the City Council Shortly—One Already Introduced for Increasing Municipal Plant

At the regular meeting on Oct. 23 of the City Council of Seattle, Wash., Councilman William Hickman Moore introduced an ordinance which was referred to the finance and city utilities committees of the Council authorizing and directing the Board of Public Works to prepare plans and specifications for certain additions and betterments to the existing municipal light and power plant, to consist of a hydroelectric power plant or plants, and to invite bids for furnishing the city of Seattle such plant or plants, complete and ready for operation, including transmission line to the city, in conformity substantially with the plans and specifications of the city. The estimated cost of said system or plan is declared to be, as near as may be approximated, the sum of $3,000,000. It is proposed to issue bonds in the above amount, maturing in equal annual series, the lowest numbers first without option, commencing six years and ending twenty years from their date, with interest at 5 per cent per annum, the said bonds to be an obligation against the special fund established. The bonds are not a general obligation, but are to be paid from the revenues and proceeds of the system. The ordinance binding the city not to sell, lease or in any manner dispose of the light and power plant until all obligations outstanding or payable from the special fund shall have been paid in full.

Bills for the construction of an addition to the auxiliary steam power plant at Lake Union, at a cost of between $300,000 and $400,000, and the condemnation of the Snoqualmie power plant, and the city light and power distributing system of the Puget Sound Traction, Light & Power Company operating in Seattle will, it is understood, be ready for introduction shortly. This bill will authorize the corporation counsel to institute condemnation proceedings on the Snoqualmie Falls plant and distributing system, which has been estimated at $6,500,000.

Councilman Fitzgerald, chairman of the finance committee, although expressing belief in the advantages of a complete monopoly, said he did not believe the city was able financially to undertake the condemnation of the Snoqualmie plant. The city light plant at the present time is approximately $450,000 in debt. That amount in warrants bearing 5 per cent interest has been issued; this indebtedness will be cared for by next year's earnings.

The city lighting and power business has increased at such a tremendous rate that the enlargement of its system is deemed imperative by every city official. The purchase of sites already developed and generating power has long been contemplated. Accordingly, Councilman R. H. Thompson has been making a study of the situation, securing data and information. Councilman Moore has worked out the legal details. The final purpose in view is the monopolization of the municipal light and power business in Seattle. The Council and city officials are agreed that low rates with uninterrupted service is possible only by means of several power plants generating sufficient current to supply the city's needs for years to come.

Until a new power plant is acquired no enlargement or further development of the present plant at Cedar River is possible, as that plant is taxed now almost to its capacity. It is claimed, however, that the Cedar Falls plant is developed to only 60 per cent of its possibilities. It is also claimed that the solution of the problem in the sealing of the Cedar River impounding basin is also contingent upon the acquisition of a second power plant, as the city officials do not want to disturb existing conditions for fear of interfering with the Cedar River power plant. The extreme dry weather experienced this fall has emphasized to a degree the need of acquiring another power plant. At present, the Lake Union steam auxiliary in Seattle is furnishing about 8000 of the 12,500 kw.-hr. used on peak load, in order to conserve the water supply in Cedar River. Ordinarily, less than half that amount is generated by the steam plant.

There are at least a half dozen available power sites near Seattle, whose owners have signified their willingness to develop them, provided the city would agree to purchase the completed plants. The decision of getting the best plant for the lowest price will rest with the Board of Public Works.

The proposed ordinance authorizes the board to invite bids for furnishing the city a hydroelectric power plant ready for operation, including transmission lines, under plans prepared by the board. A variation of 20 per cent in the total amount of electrical energy which may be developed will be permitted in the bids. The equipment for the completed plants will be sufficient for the installation of two units of 8333-kw. each, measurements being made at transformers in Seattle. These units will be arranged to provide for additions to the full extent of the maximum power available. Determination of the best bid will rest with the board upon the following factors: The maximum power available, the cost of current delivered at a given point in the city, and depreciation and cost of maintenance and operation of the plant as a continuous producer. The city is given the option of paying cash for the plant or issuing its bonds. None of the cost of the plant will be borne by general taxation. The expense will be met by a special bond issue against the lighting system itself.

In a report submitted to the Mayor and Council ten months ago, J. D. Ross, superintendent of lighting, pointed out the sites which could be developed for power purposes. He said a plant of at least 22,500-kw. capacity should be obtained. Among the sites available were four sites at Elwha, mostly in the Government Reserve, developing 50,000 kw.; at Sauk Suiattle, developing the same amount; the Lake Cushman site, developing 40,000 kw.; one at Packwood Lake, in the Government Reserve, developing 30,000 kw.; the Skykomish River site, developing 30,000 kw., and one on Deer Creek, developing 18,000 kw.; also P. H. Hebb offered to develop his White River site in exchange for utility bonds.

Government Ownership Inquiry

The first hearng in connection with the proposed congressional investigation of the subjects of government control and regulation of transportation and of government ownership of public utilities is to begin on Nov. 20 in the Senate office building at Washington. A statement outlining the purpose and scope of the investigation has been mailed to members of the Interstate Commerce Commission and State railroad commissions, commercial, banking and other organizations. The committee is to report to Congress on or before the second Monday in January.

NEW STEAM GENERATING STATION FOR CINCINNATI

Plum Street Station Outgrown and Plan to Abandon Miami Canal Makes Change Imperative—New Station to Be Located on Bank of Ohio River

The Union Gas & Electric Company of Cincinnati, Ohio, has improvements and betterments planned and in course of construction which will necessitate a capital expenditure of about $6,000,000. The chief feature of this work is the construction of a new power station. In addition to this the plans contemplate laying underground about 40 miles of very large three-conductor cables and making additions to and changes in eight substations.

The Plum Street generating station, which, since 1898 has been practically the only source of power for the business of the company, is irretrievably outgrown in spite of many additions and changes since it was first started. This station is located a mile "uptown," where delivery of coal is expensive; also, it is on the bank of the Miami Canal, and for some years it has been difficult to maintain sufficient water supply in the canal for the condensers. This canal is now to be abandoned entirely and filled up, so that for many reasons besides the growth of the business the company was compelled to obtain a new source of power. The old Plum Street station carried a load last winter of 31,000 kw., and in choosing the site and making plans for the new power station full consideration was given to the rapidly increasing demands for cheap electric power in a community like Cincinnati.

The new power station will be located on the site of the old "West End gas works" on the Ohio River, about 0.25 mile west of the Grand Central Depot. Two generating units of 25,000-kw. capacity have been ordered of the General Electric Company, and the building will be large enough for two more of the same size. The Ohio River at this point has a rise of 70 ft. from extreme low water to extreme high-flood level, which condition makes the circulating-water problem a very difficult one and the foundation and intake work very massive. The turbine room floor level is established 15 ft. above the extreme high water, and the condensers, which have been ordered of the Worthington Pump & Machinery Corporation, are to be placed in great concrete wells or pits below the turbines. These wells are 68 ft. inside diameter and 85 ft. deep, the condenser floor being on the same level as the extreme low water. The condenser wells, intake crib and building foundations, the contract for which has been let to The Foundation Company of New York, are now well under way. Contract for the steelwork for the building has been let to the American Bridge Company.

The two turbines will be supplied with steam from eight Babcock & Wilcox boilers of 12,600 sq. ft. of heating surface each. The boilers each will be equipped with Westinghouse underfeed stokers of fourteen retorts each and with Sturtevant economizers of 8500 sq. ft. of surface each.

The generators of the two main units are rated at 31,250 kva., three-phase, 60 cycles, 13,200 volts, 1800 r.p.m., 250 volts excitation. The switches and complete switchboard equipment and the auxiliary transformers have been ordered from the Westinghouse company.

The power will be delivered at generator voltage to the eight substations over three-conductor, lead-covered cables. These cables will be of 350,000 circ. mil and 400,000 circ. mil conductor insulated with 7/32-in. by 7/32-in. paper. The rating of these cables will be approximately 7000 kva. There will be about 40 miles of this cable for the initial installation.

Three of the substations will supply direct current to the Edison distribution system. In addition to the present motor generators there will be installed in these substations three 3500-kw., 60-cycle-booster, synchronous converter equipments. These converters will be normally rated at 13,000 amp. and 270 volts, and will be the largest machines of their class built thus far. These converters and their transformers have been ordered from the Westinghouse company.

One of the Edison substations will also supply alternating-current service. This station and five existing alternating-current stations will continue to distribute 2500/4500-volt, three-phase, four-wire, alternating-current service. A total of 30,000 kva. of transformers, in banks of three 2000 kva. transformers, will be required for this purpose.

The plans of the company provide for the manufacture of bulk power on a large scale to meet the growing needs of the city, not only for lighting but for industrial power. It will also supply power far beyond the city limits into Kentucky and Indiana, and as far north as Middletown, Ohio.

The engineering work is being handled by Sargent & Lundy, consulting engineers, Chicago.

DOHERTY COMPANIES PLAN CONSTRUCTION CHANGES

Engineer Williams Says This Winter Will See Many Changes That Will Be Profitable from an Operating Standpoint

Construction and operating plans completed and under advisement forecast a busy winter season for the Doherty properties, according to W. G. Williams, construction engineer of the Doherty organization.

One improvement is that contemplated in connection with the turbines of the Empire District Electric Company of Joplin, Mo. It has been a problem to keep these machines in good running order, Mr. Williams stated, and with a view to arriving at some definite action he met C. E. Carter of the Empire company and George W. Saathoff of the Toledo Railways & Light Company, formerly of the Empire company, in Pittsburgh recently, and had a conference with Mr. Hodgkinson, chief engineer, and Mr. Ferguson, head of the service department of the Westinghouse Electric & Manufacturing Company. After much deliberation it was decided to prepare dummies to take the place of the 6-in. intermediate blading in both Joplin turbines, so in case of a breakdown the 6-in. blading could be left out and the turbine operated at approximately 10 per cent off the maximum rating. This, it is believed, will solve the problem and avoid further shutdowns.

Two new boilers for the Empire company are now on the ground and the superheaters are going through with tracers. Two erectors are on the job so that the work of erecting the new boilers will proceed continuously.

The contract for a 10,000-kw. turbine and 4000-hp. in boilers will be let shortly. This equipment is for the Trumbull Public Service Company's load.

What is expected to materially benefit the Danbury (Conn.) & Bethel Gas & Electric Company's coal handling is the building of a switch and coal trestle connecting with the New York, New Haven & Hartford Railroad. In a conference with an official of this company at which C. H. Merritt, general manager of the Danbury company, was present, an agreement was reached whereby this improvement will be instituted. This will enable the Danbury company to store 1000 tons of coal and greatly facilitate coal handling. A

contractor is now on the ground excavating the additional storage space.

Authorization has been granted the Lorain County Electric Company to increase its power plant with a 7500-kw. turbine and 1000 hp. in boilers. Automatic stokers will also be installed under the existing boilers. The Lorain company has also been authorized to improve its coal handling facilities.

CONVENTION OF RAILWAY ELECTRICAL ENGINEERS

Industrial Trucks, Lighting, Anti-Friction Bearings, Electric Welding and Tests of Metal Conduit Are Among Subjects Discussed—J. C. Causland of Pennsylvania Lines Elected President

Following its usual custom the Association of Railway Electrical Engineers at its ninth annual convention at Chicago, from Oct. 31 to Nov. 3, had its work laid out in the form of committee reports. Since these reports had been published in advance, time was available for full discussion of all subjects.

Although the committee on industrial trucks did not present a definite report, there was considerable discussion on this topic. The general preference seemed to be for 24-volt motors as against 47-volt equipment. It was brought out that the 24-volt apparatus gives less trouble, since it has fewer cells of battery. There are consequently fewer connections and less sloppage of electrolyte. It is also easier to charge 24-volt equipment, since it operates at practically the same voltage as car lighting equipment, and can, therefore, be charged from the same apparatus. It has, however, one disadvantage; it is said that the 24-volt trucks will not climb 16 or 18 per cent grades. It was suggested that this trouble can be overcome by using a gear reduction. This plan is in use on trucks used by the Canadian Pacific Railroad.

Discussion on Locomotive Headlamps and on Flood-Lighting Railroad Yards

The discussion of the report of the committee on headlights had to do largely with legislation on this subject. It was stated that the Interstate Commerce Commission has passed a ruling to become effective on Jan. 1, 1917, which says in effect that the headlight shall be strong enough so that the engineer can see a man dressed in dark clothes on the track at a distance of 1000 ft. The discussion also showed that for engine headlamps the railroads are drifting away from the use of the arc lamps, and toward the use of type C tungsten lamps, which are mostly of the 32-volt, 250-watt size. These lamps, it is said, have a life of three months under the severe conditions of service encountered in railroad locomotive work.

The discussion on lamps brought out that on one railroad the electrical engineer tried to use automobile lamps because they were cheaper. These lamps, however, were stolen by the locomotive engineers and by the shop men for use on their automobiles. This added greatly to the electrical department's expense. The automobile lamp socket was also found too delicate for train use. The discussion, moreover, showed that it costs $1 per engine per month more to light a yard engine with oil than it does to light the same engine with electricity.

Following a progress report by a committee which is preparing a handbook of data for railway electrical engineers, yard lighting was brought up for consideration. Interest centered almost entirely around flood-lighting. With this system in railway yards it was stated that the mounting height of lamps should be between 75 ft and 90 ft. Glass reflectors give a better light tone than other types. Some success has attended the efforts to reduce shadows by lighting yards with flood-lighting units at both ends of the yards. Later, in a lengthy discussion of train lighting, it was established that an average cost for car lighting is about $18 or $20 per car per month.

Co-operation with Electric Power Club

The committees on anti-friction (ball and roller) bearings and on crane, turntable and transfer-table motors, indicated that the association is co-operating with the Electric Power Club. The discussion showed plainly that anti-friction bearings are meeting with favor. One engineer pointed out that but forty failures occurred in 5417 ball bearings on car-lighting generators, while 129 failures were recorded from 2909 ordinary bearings in the same class of service.

Ideas in Shop Practice That Save Money

In the discussion on shop practice an instance of a profitable electric welding installation was cited. On the New York Central Lines a welder was installed four years ago at a cost of $7,000. In a single month this outfit recently saved the company $1,375.18 by reducing the costs on miscellaneous shop repair jobs. On the Rock Island lines the use of a small electric welder in any part of the shops or repair yards is made possible by placing the entire equipment on a ball-bearing truck so that it can be easily moved about. Receptacles capable of delivering 5 hp.—the demand of the set—are placed at convenient places about the shops and yards of the railroad company.

In reply to a query on the use of motors instead of air tractors for turntables, an engineer for the Rock Island lines said it cost $90 a month less to operate a motor-driven table than one driven by an air tractor. This table turns 1800 engines a month; furthermore, it gives much less trouble than any driven by tractors using compressed air.

Further discussion on shop practice brought out the fact that conduit painted with a cement grout will withstand the action of sulphur fumes better than bare conduit or conduit covered with ordinary protective paint. As another stunt in pipe painting it was stated that pipes coated with a paint containing pulverized cork would not "sweat."

Later the report of the committee on metal conduit specifications made it known that comprehensive tests on this product are under way. The object of these tests is to find out what conduit is best for use under different conditions. The problem is being approached by installing bare and coated conduit of all makes in straight pieces and in bends in places where it is subject to the action of sulphur, salt and other destructive agencies. Frequent observations of the specimens are being made and photographs of noteworthy developments are being taken. The committee which is following this work expects to make a definite report in one or two years hence.

Election of Officers

The election of officers resulted as follows: President, C. J. Causland, Pennsylvania Lines; senior vice-president, J. E. Gardner, Chicago, Burlington & Quincy; junior vice-president, L. S. Billau, Baltimore & Ohio; secretary-treasurer, J. A. Andreucetti, Chicago & Northwestern; new members of the executive committee, F. J. Hill, Michigan Central, and A. Voight, Santa Fé. The next annual meeting of the association will be held in Chicago.

Developments in Meter Testing Methods and Apparatus

How the Pacific Gas & Electric Company Has Improved Upon Early Methods of Meter Testing and Has Developed a So-called "Load-Applying" Method of Test That Is Used for All Classes of Meters

BY OTTO A. KNOPP

Superintendent of Laboratory Department Pacific Gas & Electric Company, San Francisco, Cal.

DURING the last thirteen years that the writer has been connected with the Pacific Gas & Electric Company many forms of meter testing have been thoroughly investigated and apparatus developed that eliminates many of the disadvantages and weaknesses observed. To aid others who may be directing their efforts along lines which the writer has found unsatisfactory, certain experiences with different forms of testing are related in what follows, and a method explained which has been found very satisfactory by the Pacific company.

One of the first meter-testing methods that was observed during the period mentioned involved the use of indicating ammeters, voltmeters and undamped wattmeters, the latter being used to test alternating-current watt-hour meters, while the ammeters and voltmeters were used for direct-current meters. The consumer's load was invariably used for such testing. Since voltage regulation was not as carefully maintained in those days (1903) as at present, however, the use of undamped indicating wattmeters was extremely unsatisfactory on alternating-current tests, due to the fluctuation in load. The first improvement was introduced that summer when a special rotating standard was constructed from a commutator type meter with a set of eight current coils. These were connected to a plug board on the outside of the case so as to permit joining the coils in parallel, series, or in series parallel, to give current ranges from 10 to 20 to 40 to 80 amp. Potential taps were brought out for testing meters on 110, 220 and 550 volts. In order that the tester could count the revolutions by means of a telephone receiver, a telephone contact was provided. With this apparatus connected in series with a customer's meter, the tester could thus count the revolutions of the latter with his eye and the revolutions of the rotating standard with his ear. The ratio of the two products of revolutions multiplied by the constants of the two respective meters gave the correction factor of the meter under test.

This method was found to be quite an improvement over the old indicating method, as it eliminated the necessity of averaging the load over an appreciable period of time—a task which was quite difficult with the available indicating instruments and fluctuating load. This rotating standard was used for both alternating-current and direct-current work, and was also provided with a "Y" box resistance to be used for measuring balanced three-phase loads. The principal value of this apparatus was its flexibility, since a single instrument could be used for the whole field of meter testing. Several instruments of this kind were put into service, but the weight of the standard was excessive, being about 25 to 27 lb. and rather too heavy for one man to carry.

Consequently in the following year (1904) the weight was reduced to 14 lb. by using the first type "C" General Electric meter that came to the Coast. After quite extensive experience with this rotating standard, which is shown in Figs. 1 and 3, it was found that the inherent error was too great, due to changes in temperature of the surrounding air or variations in the circulation of air through the potential resistance units and to the uncertain friction of the commutator and temporary obstructions. Therefore, it was decided to abandon this method of testing, at least for alternating current, in favor of a new test method and new testing apparatus.

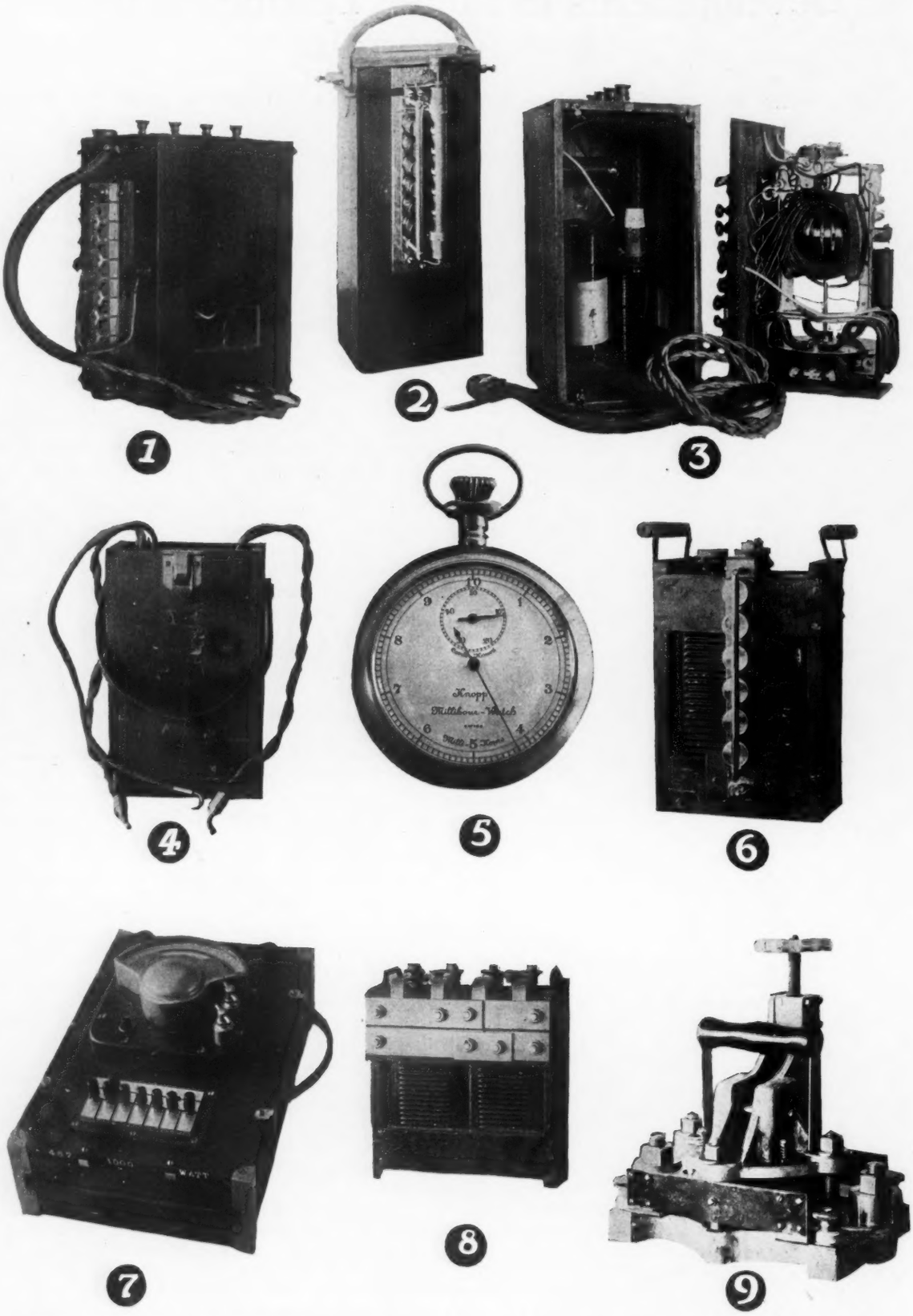
ROTATING STANDARD ABANDONED FOR LOAD-APPLYING METHOD

The new method was based on the principle of applying definite loads to the meter rather than measuring loads which happened to fall on the circuit. Gradually this load-applying method has been adopted for all classes of testing, as will be shown later in this article. A short description of this method appeared in the April 14, 1906, issue of the ELECTRICAL WORLD in connection with a description of the writer's milli-hour stop-watch, and later in the July 27, 1907, issue of the same publication in an article on "Meter Testing."

Briefly, the method was to subject the meter to be tested to a load which would cause its disk, if correct, to make a definite number of complete revolutions in 0.01 hour, and measure the correction factor with a special stop-watch like that illustrated in Fig. 5. Since the dial of this watch is divided into 100 parts, and the hand makes one complete revolution in 0.01 hour, the predetermined load should make a correct meter complete the predetermined number of revolutions during one revolution of the stop-watch hand. If the meter was incorrect, however, the watch would register a certain number of hundredths below or above one revolution of the hand. Thus if it registered 1.04 revolution it would mean that the meter ran slow and that the reading should be multiplied by the factor 1.04 to correct it. If the watch registered 0.96 revolution the meter reading should be multiplied by the correction factor 0.96. The use of a correction factor is decidedly more desirable than the use of per cent fast or slow, or per cent accuracy, since more calculations are required when using the latter expressions, hence mistakes are liable to be made. The predetermined load to which the meter has to be subjected in the foregoing test is obtained by multiplying the disk constant by 100 times the number of disk revolutions desired in 0.01 hour.

The first alternating-current meter testing set and milli-hour stop-watch were put into service in 1905. The original instrument was of a small capacity and intended only for the rapid testing of 5-amp. induction-type watt-hour meters. It weighed 5 lb. and had a rating of 300 watts, making it sufficient to test 5-amp. meters on 10 per cent and 60 per cent loads. The success, convenience, accuracy, ruggedness and speed which were obtained with this set prompted an increase of rating during the following year to 450 watts, and in 1907 to 650 watts.

On account of the favorable results obtained with the watt-applying method, it was also introduced in the shop for testing all sizes of meters. Instead of employing the portable load-applying set, however, a lamp bank was used in connection with an indicating wattmeter. To hold the load constant at any desired



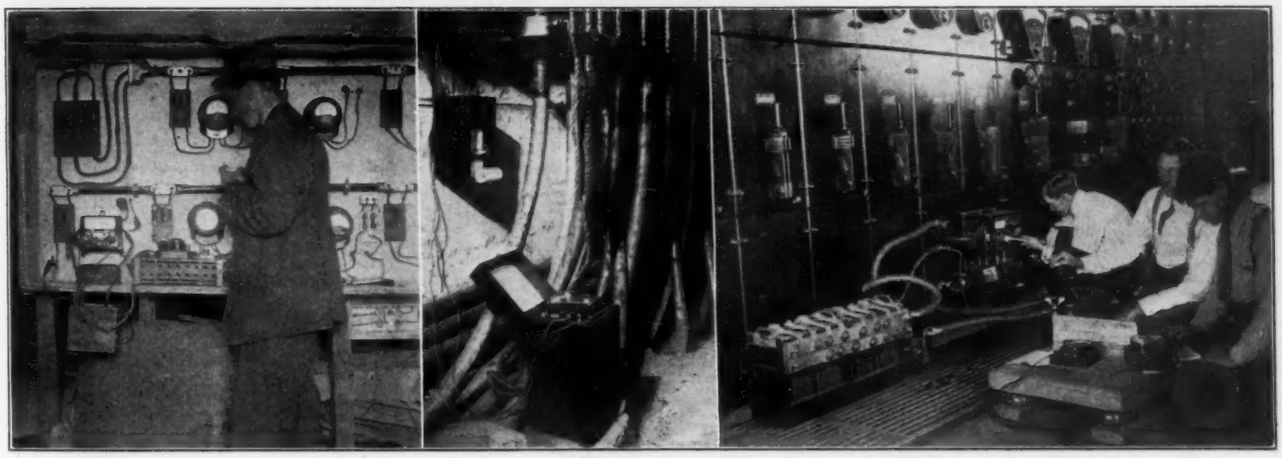
Meter-Testing Apparatus Developed for Pacific Coast Company

Fig. 1—Light-weight rotating standard with telephone receiver for counting rotations; Fig. 2—A-4 nickel-iron cell equipped with carbon rheostat for testing meters. Fig. 3—Interior of rotating standard; Fig. 4—650-watt multiplier; Fig. 5—Stop watch calibrated in thousandths of hour; Fig. 6—A-12 nickel-iron cell equipped with carbon rheostat for testing relatively large meters; Fig. 7—Portable set used in testing meters up to 1000 watts rating; Fig. 8—Two A-12 nickel-iron cells; Fig. 9—Carbon rheostat used in testing 600-amp. meters.

value a slide-wire resistance was provided, and the correction factor determined by a milli-hour stop-watch.

Despite the extensive use of the load-applying test method, however, the previously mentioned rotating standard was used for field testing of large capacity alternating-current meters until 1908, when a so-called multiplier was designed to increase the rating of the testing set to five, ten or twenty times that of the full rating of the 650-watt set. One of the latter is shown in Fig. 10 below the service meter, and a later construction in Fig. 4.

While the weights of the 650-watt set and multiplier were both about 8½ lb., the tester was obliged to carry only a comparatively small load, since a considerable amount of testing was done without the multiplier. When the multiplier is used the equipment is divided into two equally heavy parcels, which can be carried about with ease. The little alternating-current testing set became quite popular and was greatly preferred to the rotating standard in its original and subsequent forms. This testing set, which was carried in a light wooden box, consisted of two sets of resistances; one, a set of standard resistances which served as loads for the meter under test; the other, a set of variable resistance employed to maintain constant current through the standard resistances.



FIGS. 10, 11 AND 12—USING ONE OF THE ALTERNATING-CURRENT LOAD-APPLYING TEST SETS EQUIPPED WITH MULTIPLIER; PORTABLE APPARATUS, INCLUDING RATIO RELAY BEING USED TO TEST DEMAND METER; EMPLOYING FOUR A-12 NICKEL-IRON CELLS WITH CARBON RHEOSTAT TO TEST RAILWAY METERS

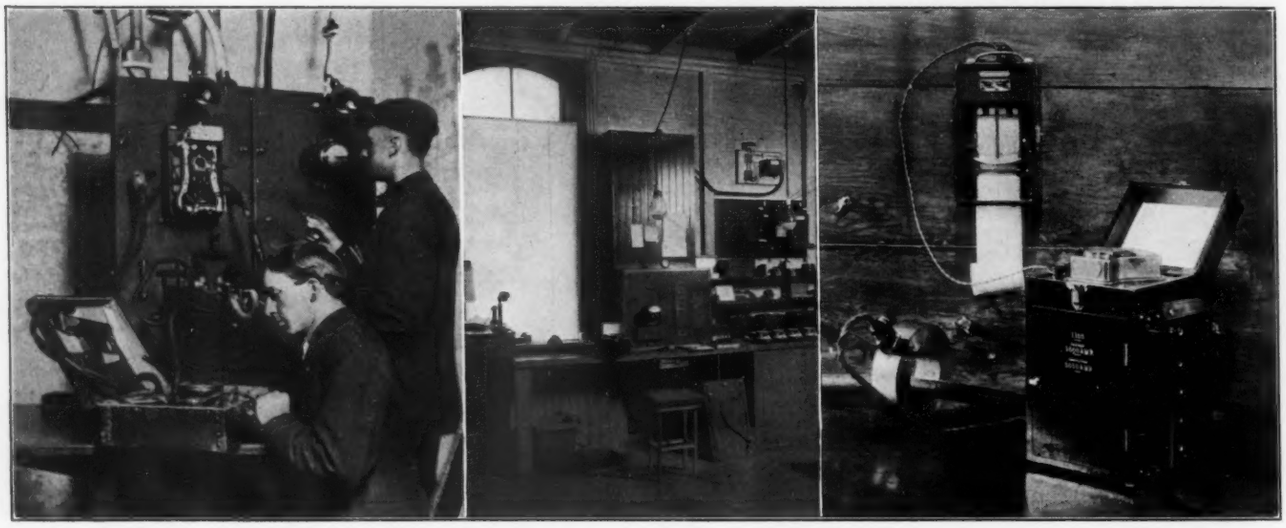
ADVANTAGES OF LOAD-APPLYING TEST METHOD

Among the advantages on the load-applying test are the following: The instrument is small and light (size 13 in. by 8½ in. by 5 in., and weight 8½ lb.), thus enabling the tester to cover more ground. Since it contains the load, the tester is able to test every accessible meter independent of the consumer's load. Connections for testing can be easily made and any size alternating-current meter can be tested quickly and accurately without calculation when the set is used in connection with a milli-hour stop-watch. Voltage fluctuations do not affect results since the meter tester maintains constant readings by means of a regulating slide. As only a few definite loads are required in this method, they are calibrated from time to time by direct comparison with a standard wattmeter, hence the tester can maintain exactly the right wattage independent of any scale correction of the ammeter. No errors are introduced by changes in frequency, wave shape or temperature, therefore the instrument will transfer the standard wattages very accurately, especially since only the closest reading part of the scale is used for all wattages. In all other methods it is necessary to apply scale corrections, which necessitate interpolations and calculations in order to derive the correct values. This instrument is very rugged, the movable element being supported during transportation so that even a severe fall will not affect the calibration of the set.

Uniform accuracy is obtained over a wide range of wattages, since all values are read on the same part of the scale. The accuracy of this method depends, therefore, chiefly on the accuracy and the stability of the standard resistance, which are extremely high. The instrument enables not only the testing of watt-hour meter, but also the determination of voltage, current and power factors. This function is sometimes an important feature in testing primary installations where potential transformers have become defective. An ordinary wattmeter, either rotating or indicating, will not detect any discrepancy due to improper voltage being applied to the meter. With a rotating standard the test is simply a test of meter against meter, and if any disagreement is found between the two, invariably the accuracy of the standard is doubted, particularly in all cases where there is a large scattered territory to be covered without opportunity for checking the standard each day. If the needle of the ammeter used with this set swings freely and comes to rest properly on zero, the instrument is bound to be right, since all changes in the calibration of an ammeter are of a slow nature, *e.g.*, weakening of the spring or the aging of the iron. Such changes are taken care of in the calibration of the set at intervals of a month or so. The standard resistance is equally permanent in characteristics. In some cases instruments have been in daily use for a year at a time without laboratory calibration, and have been found to possess the exact original calibration within the limits of observation. The voltage of the meter circuit can be read at any time during the test without changing any connections, and current, within the range of the ammeter, can be read by using the regular ammeter terminals without disconnecting it from the set. By means of the multiplier, the ammeter range can be increased in proportion to the ratio of the multiplier. By determining the current and voltage of the circuit, the apparent watts passing through the meter circuit can be obtained, while the true watt can be determined by timing the calibrated meter. In this way the power factor of the load on the meter can be found. The milli-hour watch used in connection with the instrument is useful in other respects, as it enables the tester or inspector to find the load passing through the meter in a very simple way.

This is done by dividing the disk constant by the milli-hours required for one disk revolution.

Encouraged through the good results obtained for years with the indicating method for testing alternating-current meters, it was considered advisable in 1909 to go over to the indicating method for direct-current work and discard the rotating standard for both alternating and direct current. Since a new instrument appeared on the market at that time under the name of "Victor combination meter," which combined an ammeter, voltmeter and wattmeter in one unit, it was possible to construct a relatively light portable set for testing direct-current meters. The first set of this type put into service was built for testing 5 to 25-amp., 550-volt meters. Instead of using the consumer's load, testing current up to 25 amp. was obtained from a Columbia dry cell in series with the ammeter and current coils of meter under test. Line potential was applied and regulated by means of a slide-wire resistance. Later in the same year the new Edison A-4 cell appeared on the market, so it was substituted for the dry cell, which though entirely satisfactory for testing small capacity meters did not have sufficient capacity for testing large meters. It was found that the Edison cell adapted itself remarkably well to this class of work, because of its ruggedness, the absence of acid fumes, and on account of its low voltage, which reduced the amount of power wasted in the regulating apparatus.



FIGS. 13, 14 AND 15—A-12 CELL EQUIPPED SIMILAR TO ONE IN FIG. 6, BEING USED TO TEST METER; PUSH-BUTTON-OPERATED LOADING BOARD WITH MILLI-HOUR PENDULUM FOR TIMING METERS IN SHOP AND CHECKING STOP WATCHES; USING 1500-AMP. DIRECT-CURRENT RATIO RELAY TO MAKE RECORDS OF POWER DEMAND

How Carbon Rheostats and Nickel-Iron Cells Were Used

Several portable batteries equipped with light specially designed carbon rheostats were placed in service early in 1910 in connection with the previously mentioned testing set, which is shown in Fig. 7. The plug resistances used prior to that time were discarded, as well as the potential regulator, because it was found possible to maintain a constant meter load by regulating the current by means of the carbon rheostat. Since it was found desirable to have something more accurate than a stop-watch in the shop, a milli-hour stop-pendulum was introduced in 1911. This device, which is shown at the left of Fig. 14, is just as convenient for indoor testing as the stop-watch, permits the same speed as was achieved with the stop-watch, and also serves as a time standard for quickly checking the stop-watches.

Testing large direct-current railway meters, ranging from 2000 to 4000 amp., was another problem that was attacked the same year. Up to that time the meters had been tested with the railway load, over which the tester had no control, thus it was difficult to determine whether to regulate the light or heavy load-adjusting devices. Since the carbon rheostat in connection with the Edison cell had given such good results, an interesting system of testing was tried out, namely, that of controlling the meter current by means of a rheostatic carbon shunt. A quick-acting carbon rheostat was designed which could handle up to 3000 amp. to shunt the meter and indicating test instrument. This scheme worked out fairly well, it being found by subsequent tests that it was actually possible to shunt a railway load fluctuating from 2000 to 4000 amp. in such a way that a constant current of, say, 1000 amp. would flow through the meter. The only difficulty encountered was shielding the meter from the stray field of the shunted current during light-load tests.

While means of overcoming this obstacle was being considered the A-12 Edison cell appeared on the market. As such good results had been obtained with the smaller A-4 Edison cell for testing the small meters, an attempt was made to test large meters up to 4000 amp. rating by means of the new size cell, it being considered sufficient to provide a maximum of 40 per cent of full-load current for calibrating 4000-amp. meters. This conclusion was reached since the calibration curve of this particular type of meter is practically a straight line. To make use of the Edison A-12 cells the previously mentioned carbon rheostat shunt was converted, with only slight modification, into a straight carbon rheostat and used in conjunction with four A-12 cells connected in parallel. With this arrangement any desired load from a few hundred amperes up to 1500 and 1600 amp. can be obtained for testing.

Provisions for Testing Direct-Current Meters

This system of testing worked out so well that in 1913 the Edison battery with carbon rheostat was adopted for testing all sizes of 500-volt direct-current meters. For testing medium-size meters rated at 75 to 300 amp., a single Edison A-12 cell was used with a carbon rheostat mounted on its side, as shown in Figs. 6 and 13. This construction was similar to that employed with the A-4 cell used for testing meters rated at 5 to 50 amp. To adapt large-capacity carbon rheostats to particular conditions in San Francisco, where medium-size railway meters of about 600-amp. rating

had to be tested, the carbon rheostat proper was redesigned to regulate from a few amperes up to about 600 amp. In addition shunts were provided and built into one unit with a rheostat so as to increase the range in several steps up to about 2500 amp., thus retaining for the high-current ranges the same fineness of regulation which the rheostat permits on the low range. A test set thus modified is shown in Fig. 9.

Further improvements were made in the meter shop testing equipment by installing a new loading and connecting board, shown in Fig. 14. By means of this it is possible, when the load-applying method is used, to load all sizes and types of meters conveniently, rapidly and accurately on 110, 220 and 440 volts, and on currents from a few tenths of an ampere to 100 amp. at any power factor, lagging or leading. A constant load of a few hundred watts is drawn from the line, but the meter load is varied through the wide limits mentioned above by means of a phantom-load transformer, the secondary of which can be loaded by two groups of resistances. Each group consists of ten graded units.

By means of three-way push-button switches the meter can be connected in series with any number of resistances desired. One group receives its current through the meter circuit, but the other group does not. In this way the meter load may be varied, but the test load is kept constant. By inserting a slide-wire resistance in the primary circuit of the phantom-load transformer perfect regulation is obtained under any load condition on the meter. Another feature of the board is a special holder that permits rapidly connecting any type and size of meter in the test circuit.

This year the alternating-current portable meter testing set was redesigned so that maximum load capacity on the set is now about 1000 watts and the weight the same as before. The load resistances have been so proportioned as to apply between 90 per cent and 100 per cent of full-line voltage to the meter. Improvements in the regulation were also made, and readings of the line voltage are obtained more easily and accurately than before. See Fig. 7. Further improvements were also introduced in testing large railway meters. Heretofore only the current was regulated and the voltage averaged during the period of the test on an indicating Weston voltmeter. To obtain the highest degree of accuracy possible, means for regulating the voltage on the meter were provided so that with only a small expenditure in battery energy accurate results can be obtained with one or two reliable readings in a comparatively short period of time. This was permitted by connecting a fine slide-wire resistance in series with the voltmeter and the potential coil of the meter. The meter is then tested for the average voltage under which the particular circuit is operating during the month preceding the test, monthly tests being made on all railway meters. In many cases the circuit voltage could be slightly raised for the time of the test to somewhat above the average to be held by the tester with his regulating rheostat. In some places where this voltage rise cannot be secured in any other way, a set of small dry cells is inserted in the potential circuit to raise the voltage sufficiently to allow regulation.

Although it did not appear at first that the development of instruments for measuring direct current without the opening of the circuit had any relation to the problem of improving metering apparatus and meter-test methods, it was found later that these two problems were very closely associated. The so-called direct-current ratio relay, which was the outcome of the first-mentioned development, opens up new possibilities for metering direct current or testing direct-current meters. It introduces a new link in the line of direct-current measuring apparatus equivalent to the well-known instrument transformer used in alternating-current measurements. Details of this apparatus were described in the ELECTRICAL WORLD of the Oct. 2, 1915, issue. Very recently an instrument of this type rated at 1500 amp. was put into service for taking curve-drawing records of the energy demand of large direct-current consumers. It is shown in Fig. 15.

CHARACTERISTICS OF ELECTRIC REVERSING MILL

Effect of Flywheel in Smoothing Out Load Peaks, Energy Consumption Per Ton of Product and Operating Expenses

An interesting example of American practice in the electric operation of reversing blooming mills was presented by J. E. Jefferies, electrical engineer of the Steel Company of Canada, at a recent meeting of the Association of Iron and Steel Electrical Engineers. The operation of a 34-in. reversing mill in the Steel Company of Canada's works at Hamilton, Ont., was described. This mill is driven by the Ilgner system, which employs a heavy flywheel in conjunction with a motor-generator set and a device that will enable the flywheel to give up some of its stored energy when the demand for power is great, thus reducing the peak load which would otherwise have to be carried by the motor.

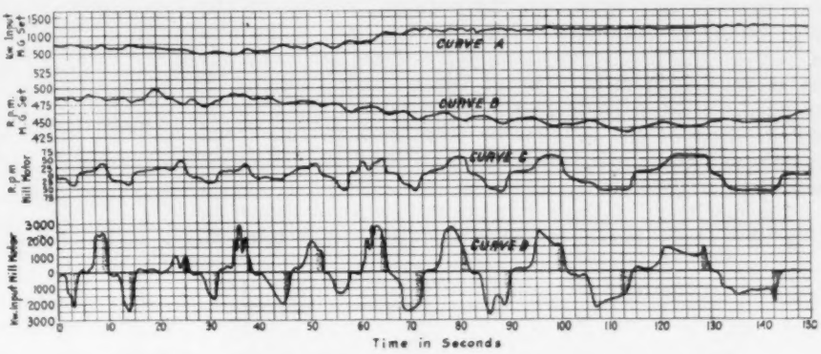


FIG. 1—RELATIVE INPUTS TO MILL MOTOR AND FLYWHEEL MOTOR-GENERATOR FEEDING IT

The motor-generator set consists of an 1800-hp., 2200-volt, three-phase wound-rotor induction motor, a 50-ton flywheel, and two 1200-kw., 600-volt direct-current generators, all mounted on the same shaft. All of the field current for the motor and generators is furnished by a 175-kw., 250-volt exciter. Two shunt-wound interpole motors, mounted on the same shaft, are employed to operate the mill. Each of these units has a continuous rating of 3000-hp., so the two units are capable of delivering momentary peaks of 9000 hp.

The characteristics of this equipment are clearly shown in Fig. 1, which represents graphically the kilowatt input to the motor-generator set (curve *A*), the variations in speed of the motor-generator set (curve *B*), the speed and direction of the mill motor (curve *C*), and the input of the mill motor (curve *D*). While these curves are not an average of observation, they are typical simultaneous curves, and illustrate the action of the slip regulator and flywheel in minimizing the fluctuations in power demand. In this case, the maximum input is about 1200 kw., the speed of the flywheel varying between 490 maximum and 435 minimum,

whereas the load on the mill ran as high as 3000 kw. Since the rotative energy of the flywheel is proportional to the square of the speed at which it is turning, a reduction of 15 per cent in speed means 27.75 per cent of the whole rotative energy of the flywheel is absorbed during the short period of speed change. Normally, between 15 and 20 per cent reduction of speed is allowed. The shaded areas of curve *D* represent reversing periods during which the rotative energy of the mill motor is returned to the flywheel set. The efficiency of this exchange is only about 60 per cent, but in steam-driven mills none of the reversing energy is utilized. During some of the short passes the time of acceleration of the mill motor from zero to full speed is only one and one-half seconds, but this time lengthens with longer passes.

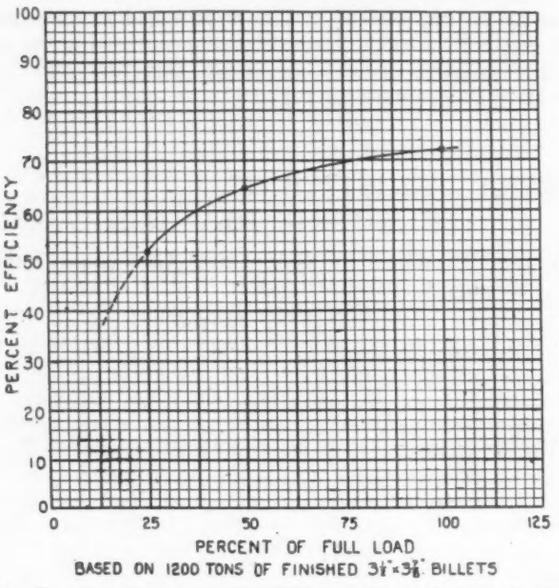


FIG. 2—EFFICIENCY OF FLYWHEEL MOTOR-GENERATOR AT DIFFERENT LOADS

The efficiency of the set taken as a unit is shown in Fig. 2. It is based on approximately 1200 tons of 3.5-in. by 4-in. billets, all data being taken from curves *A* and *D* in Fig. 1. According to curve *A*, the input is 139,043 kw.-sec., which gives 19.81 kw.-hr. per ton of steel and an average input of 959 kw. During the period covered by the data, ingots measuring 15 in. by 17 in. were handled and reduced to pieces ranging from 3.5 in. by 3.5 in. to 8 in. by 8 in.

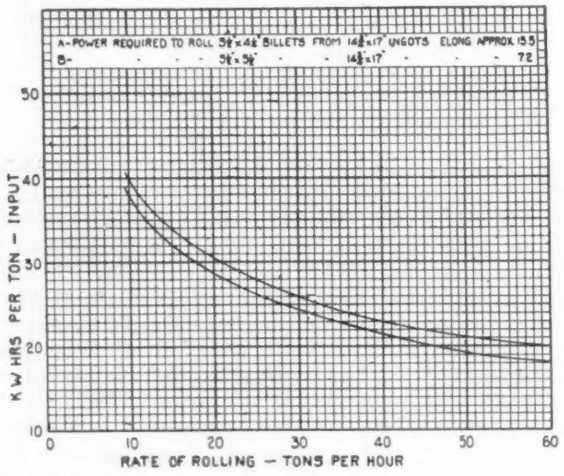

A-POWER REQUIRED TO ROLL 3½"×4" BILLETS FROM 14½"×17" INGOTS ELONG APPROX 15.5
B- " " 3½"×3½" " 14½"×17" " " 72
KW HRS PER TON - INPUT
RATE OF ROLLING - TONS PER HOUR

FIG. 3—UNIT ENERGY CONSUMPTION FOR DIFFERENT RATES OF ROLLING STEEL

TABLE I—OPERATING COST PER TON

Year	1913	1914	1915	Average or Total	Per Cent
Months operating	9	8	12	.....	.....
Tonnage	119,230	92,622	174,460	386,312	.....
Kilowatt-ton	23.9	22.8	21.5	23.4	.....
Power cost	$0.160	$0.153	$0.144	$0.157	86.8
Repairs and maintenance	$0.0069	$0.0092	$0.0045	$0.0064	3.5
Miscellaneous supplies	$0.0045	$0.0049	$0.0025	$0.0036	2.0
Labor in operation	$0.0141	$0.0161	$0.0128	$0.0140	7.7
Total cost	$0.1855	$0.1832	$0.1638	$0.1810	100.0

Ordinarily, the draft in the first passage ranged between 2 in. and 2.5 in., but reductions as great as 4 in. were made in trials to see what the equipment would stand. The speed of the mill motor at full torque is 72 r.p.m., and is 125 r.p.m. at reduced torque. The fractional load readings in Fig. 2 were obtained by assuming the friction losses of rotation to be 50 per cent and taking readings from curve *D*. The output was obtained by plotting a curve parallel to curve *D*, which allows for the inefficiency of the motor. It may be pointed out that the unit consumption of 19.81 kw.-hr. per ton agrees very closely with curve in Fig. 3 taken from actual operating conditions. This indicates that the efficiency curve is thoroughly reliable under conditions assumed; that is, with a maximum tonnage and minimum size that it is possible to turn out with the mill.

In Table I are given the operating costs for the Hamilton works for three successive years. In 1913 the mill operated only nine months out of the year, and the rate per ton is high, as would be expected for the first period of operation. Considering the tonnage rolled, 1915 was a very fair year. The individual items will represent very closely actual continuous running figures, allowance being made for variations in tonnage. Labor, repairs, maintenance and miscellaneous supplies cost about $0.0198 per ton during 1915.

TABLE II—TOTAL COST OF STEEL ROLLED PER TON

Year	1913	1914	1915	Average
Total operating costs (no overhead)	$0.185	$0.183	$0.164	$0.181
Interest on investment ($156,000)	.078	.101	.054	.073
*Depreciation (twenty years)	.065	.084	.045	.060
	$0.328	$0.368	$0.263	$0.314
*Miscellaneous	.126	.133	.115	.117
Total	$0.454	$0.501	$0.378	$0.431

*See text.

The total cost of rolling the steel per ton is shown in Table II. Obsolescence is not taken into account with depreciation, but the equipment is considered valueless at the end of twenty years. Energy for electric light, power for cranes, pumps, tables, conveyors and other auxiliary equipment in the blooming mill are included in the item marked miscellaneous. The largest item, power cost, is exact, as energy is metered. Other charges are made directly with no estimating, so the result is the exact cost of rolling the steel. To permit comparisons, energy consumption of another electrically-driven reversing mill is shown in Table III.

TABLE III—UNIT ENERGY CONSUMPTION FOR REVERSING MILL

Ingot	Bloom, Inches	Elongation Inches	Kilowatt-Hours per Ton	Remarks
18-in. round	7⅜ by 7⅜	4.66	8.5	High carbon
18 in. by 20 in.	3 by 8	12.2	17.2	High carbon
18 in. by 20 in.	2 by 16	9.2	14.5	Soft steel
18 in. by 20 in.	4 by 4	18.5	19.4	
17 in. by 15 in.	4 by 4	16.0	17.9	
20 in. by 20 in.	5 by 5	16.0	19.0	
20 in. by 20 in.	8 by 8	6.25	12.7	

Tests To Determine Heating of Underground Cables

Practical Methods for Conducting Investigations of Cable Heating to Determine Safe Load for Summer Operation and Results of Such Tests

BY HENRY A. COZZENS, JR.

THE heating of high voltage underground cables has in the last few years been given considerable attention by underground construction engineers. The multiplicity of failures in certain cables during the summer months has also caused some operating companies to reduce the ratings of cables during such periods. Recently considerable data on the heating of electric cables have been brought to the attention of transmission engineers. These data represent no little expense of both time and labor and are the result of a fine grade of scientific investigation. The experiments have been made under the direction of experts and the data obtained, principally under experimental conditions and with the use of special construction, have been very helpful in solving heating problems. Little data are available showing the behavior of cables in routine operation in the every-day duct line for the reason that the average operating company will not provide the equipment to conduct tests.

The information in what follows here is presented to illustrate methods for conducting comparative tests which possess facility and cheapness and yet are accurate enough for the purpose of determining the proper load at which to operate cables. These tests can be made by any operating engineer at little cost and the data applied to meet local conditions.

The current carrying capacity of a cable is influenced mostly by the characteristics and properties of the medium which surrounds it. If the cable is placed in a conduit line, the conditions which influence the rating are the size and number of the cables near the one in question and the load conditions affecting each. The radiating or heat dissipating ability of both the cable and the duct line are other conditions which affect the loading. The primary condition, however, is the thermal characteristic of the insulation or the ability of the insulation to stand high temperature without deterioration.

These factors are affected in turn by local conditions so that it becomes somewhat of a problem to definitely decide the matter of ratings. Hence it is important that individual companies, as the need requires or by periodic routine tests, record the temperatures of cable sheaths from time to time. The ratings can then be determined from this data, which have been obtained under the actual conditions, so that the method of arbitrarily placing a rating on a cable is entirely eliminated.

Where the tests are not routine all employees of the underground department may be instructed to report any cables which feel excessively warm to the touch. Men engaged in making manhole inspections or securing electrolysis data should pay particular attention to these conditions. In this manner "hot" cables are reported, and by virtue of this warning attention may be given them immediately. Sometimes nothing may be discovered, but recognition of the warning is not in vain.

Upon the receipt of reports on "hot" cables, recording thermometers should be placed in the manhole and a form of recording thermometer with an extension bulb placed on the cable sheath. A good metallic contact should be established between the lead sheath and the bulb, and then several layers of cheesecloth or felt wrapped around the sheath at the point of application. This causes no undue retention of the heat. The recording thermometers should be checked at intervals during the test with standard thermometers to insure against faulty contact or mechanical troubles with the instruments. The duration of the test should be several days so as to secure an average of operating condition.

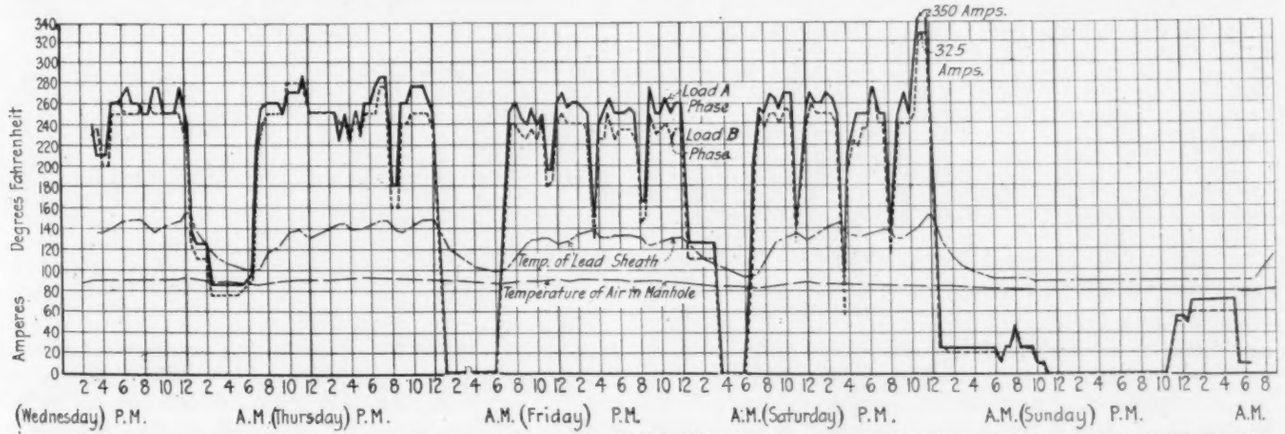


FIG. 1—TEMPERATURE TEST ON A 4/0, FOUR-CONDUCTOR, 2400-VOLT PAPER-INSULATED LEAD-COVERED CABLE UNDER LOAD

The current on the cable may be obtained from the half hourly readings taken by the operator in a substation at either end of the line, and these values may be checked by the use of split-core transformers with instruments. In many instances the heating may be due to excessive loading, which is sometimes caused by carelessness on the part of the operator. Hence these readings may be obtained at some later date when the operator is unaware that thermometers are on the feeder, so that he will have no cause to deviate from his usual method of operation. These readings should then be plotted against time as shown in the accompanying illustrations. If the heating is found to be uniform for the entire length of cable and maintained for only short periods, arrangements can be made to use additional cables over such periods. If the heating is continuous and is only present in spots other tests should be made and provisions taken to reduce the load or replace the faulty sections.

In Fig. 1 is shown a graphic record of a test made on a feeder between a substation and several manufac-

turing plants. The cable consisted of a 4/0, four-conductor, 2400-volt paper-insulated, lead-covered cable. The insulation was 3/32 in. around each conductor with a 3/32 in. belt over all. If the empirical rule of one ampere load per thousand circular mils of cross-sectional area were followed, the current carrying capacity of this cable would be between 215 to 225 amp. The average loading while in service was in excess of the value, reaching a maximum of 325 amp. on one phase and 350 on the other. In this case the heating was due to the I^2R losses of the conductors. Investigation showed that a consumer had without warning connected his whole load to the feeder because of shutting down his private plant.

This method of investigation is not as accurate as might be expected under conditions as they exist in a laboratory. The observations are, however, accurate enough for use as a basis for load reduction or for the adoption of other means to eliminate the heating.

It has been established that the maximum copper temperature of a paper, insulated cable for safe continued operation is 85 deg. C. or 185 deg. Fahr. There are various formulas for deriving the temperature difference between the conductor and the lead sheath. The results from the use of these formulas indicate that the difference is in the neighborhood of 25 to 50 deg. There is a considerable difference of opinion on this question, and inquiry among operating companies has shown a range of 10 deg. to twice the sheath temperature.

The method of taking the temperature of the sheath as described gives a result which is lower in value than the true. In the first place the temperature of the sheath is taken in the manhole, which is often ventilated, thereby increasing the radiation. In addition there are errors in the method of obtaining contact between the thermometer bulb and the sheath, so that the temperature of the sheath as plotted in the illustrations is less than that which actually exists. This condition is appreciated and accepted in lieu of more exacting test methods. The conclusions, therefore, as to the extent of the heating are taken as less serious than actually exist. It is obvious that the hottest part of the duct line is half way between the manholes—a difficult point at which to observe temperatures regularly.

The safe maximum operating temperature for lead sheaths has been taken from 90 deg. to 150 deg. Fahr. A fair average would be about 130 deg. Fahr. This value may be safely accepted as a criterion and the load adjusted accordingly, so as not to cause the temperature of the sheath to exceed this value. The remedy in the case illustrated in Fig. 1 was merely to reduce the load on the feeder enough to restore normal temperature.

In Fig. 2 a different phase of cable heating is shown. The cable consists of a 2/0, three-conductor, 13,200-volt paper-insulated construction with a lead sheath. The insulation is 7/32 in. around each conductor, surrounded by a 7/32 in. belt, over which the lead sheath is placed. Considerable trouble due to frequent burnouts was experienced with this cable, and it became excessively heated in spots. Thermometers placed in various locations revealed that the cable would be hot in one manhole and comparatively cold in another. The carrying capacity should have been in the vicinity of 160 amp., but the load rarely exceeded 120 amp. The hot spots and the reduced operating load precluded placing the cause as losses in the conductors. Thermometers in one of the hottest manholes gave data as plotted in Fig. 2.

This cable had been in service six or seven years and was known to have been overloaded at intervals. It is of interest to note in the illustration that the cable failed with the sheath temperature at 175 deg. Fahr. after carrying a load averaging but 125 amp. for several hours. Evidently the excessive heating was due to dielectric losses. Paper removed from the cable showed the effects of excessive heating at earlier periods. It had a peculiar odor and showed few traces of the compound, resembling thickly oiled paper light in color. The heating had caused the compound to flow to the lower sections of the cable, rendering the vacant parts very low in resistance value. The losses due to the leakage currents in the baked out paper are represented as heat, to be added to the heat caused by the load carried by the conductors. As the insulation becomes heated, its resistance decreases, allowing the passage of greater currents. In this way the leakage increases and the heating becomes cumulative, so that the depreciation of the cable increases until failure occurs. As the losses increase the current carrying capacity must be reduced so as to maintain the sheath temperature within reasonable limits. Cases are on record where the dielectric resistance was so low as to cause heating with but the potential and no load on the cable.

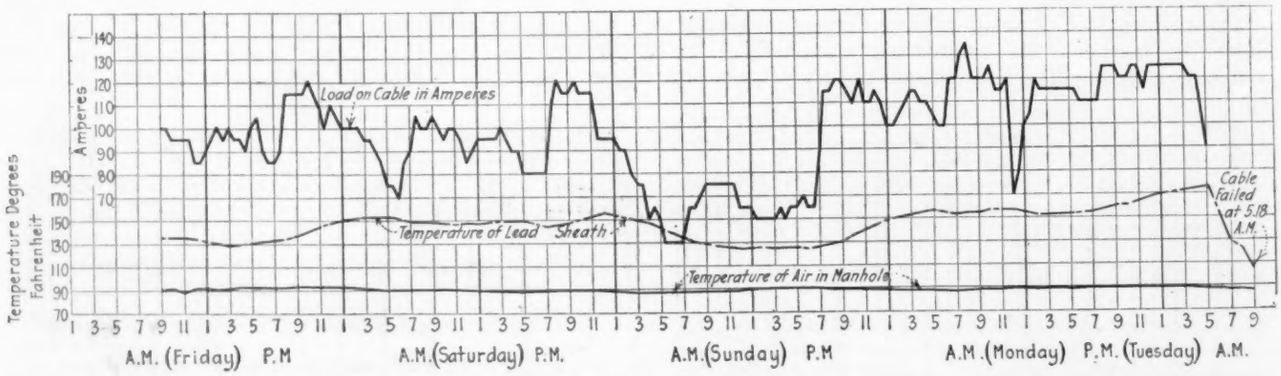


FIG. 2—TEMPERATURE TEST ON A 2/0, THREE-CONDUCTOR, 13,200-VOLT, PAPER-INSULATED LEAD-COVERED CABLE UNDER LOAD

It is the practice of some companies to record the manhole temperatures and in others to record the temperature in an idle duct. As will be noted from the curves, the manhole temperature is influenced but little by wide variations of the sheath temperature. Since the manholes are often ventilated the temperature record would rarely arouse suspicion if but one or two cables in the manhole became heated.

The practice of taking temperatures is also of value in determining the current carrying capacity of cables during the summer months. Local conditions may affect one cable, so as to make the safe current carrying capacity much less than for another of the same size, but in a different locality. Companies experiencing a multiplicity of cable failures during summer months may reduce the carrying capacity arbitrarily; however, actual tests made on cables with which difficulty is experienced will give in a more practical way results upon which to base the amount of such reduction.

Centrifugal Versus Reciprocating Boiler Feed Pumps

Comparisons of Performance Under Different Operating Conditions, Use of Steam Turbine and Motor Drive and a Practical Method for Calculating Power Requirements

BY M. WILLIAM EHRLICH

WHERE continuous operation of generating stations is essential, first cost and economy are often sacrificed for reliability. In boiler plant operation, therefore, the centrifugal pump with steam-turbine drive is being favorably considered as an auxiliary in the stations of many central electric lighting, heating and power companies. Combinations of steam and electric drive for duplicate pump units are likewise finding favor.

While the general use of the centrifugal pump started about ten years ago, its invention can be traced back more than 200 years to Denis Papin in Hesse, Germany, who brought out the first centrifugal design. The developments have been very slow. Even as late as the middle of the nineteenth century mathematicians figured that this form of pump would serve satisfactorily only against very low heads, not more than 20 ft., and to this some engineers agreed. They reasoned that if a decrease in the head against which the pump had to operate would increase the efficiency, then if the head were increased sufficiently the pump efficiency would become zero, and no useful work performed. Improper design gave ground for this theory.

The underlying principles of the centrifugal pump have been mastered, however, and by developing the design of the components a highly efficient machine with different characteristics has resulted.

Performances under many different conditions and for various services show that the modern centrifugal unit is well suited for pumping moderate and large quantities against almost any practical head and at reasonable efficiencies. When steam turbines and high-speed electric motors are used for driving the centrifugal pump, it is suitable for many of the services that heretofore have been filled only by direct acting reciprocating pumps. Since the reciprocating plunger or piston type steam pump and the centrifugal have different characteristics their use depends on service conditions.

In small sizes the centrifugal pump has a low efficiency. At a capacity of about 200 gal. a minute an efficiency of 50 per cent may be expected. Below this point the efficiency falls off very rapidly, and for this reason small centrifugals are not usually recommended.

CENTRIFUGAL VERSUS RECIPROCATING PUMPS

The choice of a pump for power plant auxiliary service involves the proper consideration of first cost installed and over-all economy in meeting particular conditions which embodies efficiency of the unit, the steam or electrical energy consumption, upkeep and fixed charges. In the moderate and larger sizes the centrifugal pumping unit, either motor or turbine driven, compares favorably in first cost with reciprocating steam pumps. The centrifugal is compact and occupies a small floor space for its size, and is therefore suitable where space conditions are important. In small sizes the centrifugal pump is relatively uneconomical, requiring a large supply of steam for the turbine, or energy for the motor, but in moderate sizes the economy compares favorably with that of the reciprocating steam pump.

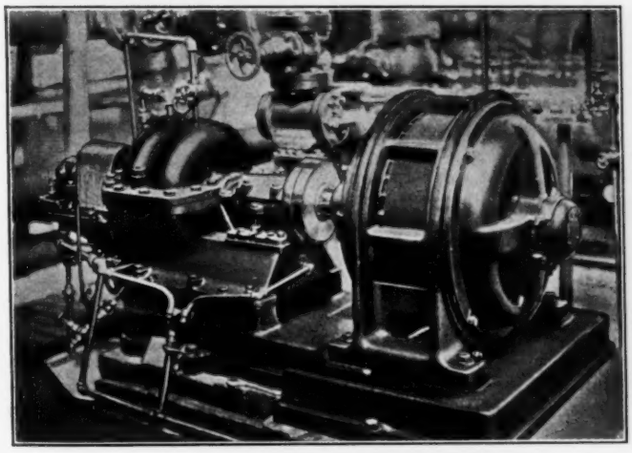


FIG. 1—A TWO-STAGE MOTOR DRIVEN CENTRIFUGAL BOILER FEED PUMP

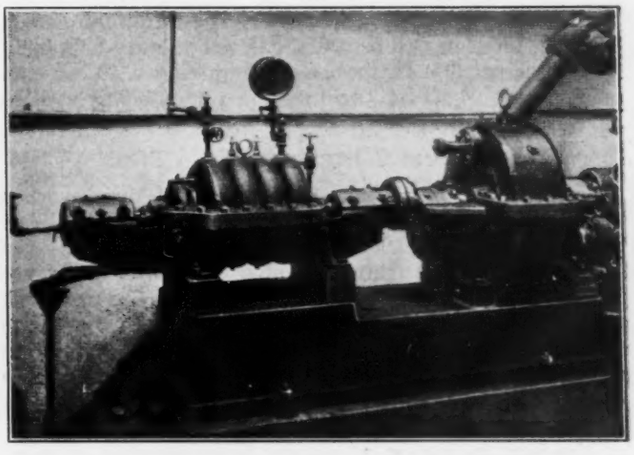


FIG. 2—A FOUR-STAGE STEAM TURBINE DRIVEN CENTRIFUGAL BOILER FEED PUMP

Electric motors and steam turbines operate at relatively high speeds, and may be either connected direct to the pump or through a reduction gear. Modern centrifugal pumps are not ordinarily built for low heads to operate at high speeds, because the efficiency would be low. The unit should also be run at or near full capacity for highest efficiency, since it cannot be efficiently regulated for wide ranges of discharge. Its overload capacity is poor, thus the size of centrifugal pumps selected must be based on the maximum load and not on average conditions. By dividing the work among several units highest results can be obtained. The centrifugal unit is of simple construction without air chambers or valves, and delivers a steady flow of water so essential to the accuracy of measuring instruments used in power-plant operation. It may be operated at a low maintenance and repair cost. Under conditions where the load fluctuates, and requires a varia-

ble pump speed, the reciprocating steam pump will be found preferable, since the economy of a centrifugal pump is poor for such conditions.

The direct-acting reciprocating steam pump is suitable for both the high and low heads found in boiler plant practice. Its speed may be varied, and it may be easily regulated for the load by throttling. The size of the pump for ordinary service may also be proportioned for the normal head. Because of this flexibility to meet operating conditions, the reciprocating pump shows a reasonably fair steam economy. The first cost of the pump is not high, but attention is necessary in operation to renew valves and packing. To take care of the inherent leakage, slippage and for slight overloads, it is customary practice to select a steam pump with a theoretical capacity of twice the normal demand of the boilers.

Reciprocating steam pumps and electric centrifugal pumps are sometimes installed in combination so that each unit may operate separately or in parallel to secure the greatest economy. In Fig. 1 is shown a two-stage motor-driven centrifugal pump, which is used for boiler feeding. In this plant reciprocating steam pumps are also used in the same service.

While practice has shown that for central station power plant service, the steam turbine-driven pump is most reliable, and that motor-driven pumps are often advisable as duplicate units or relays, it is still a debatable question whether centrifugal pumps for boiler feed are desirable in plants of less than 3000 boiler-horsepower and 125 lb. pressure. The minimum size of installation seems to be a 250-gal. per minute unit operating against 300 ft. total head requiring a 40-hp. electric motor or steam turbine, the pump being a 3-in., three-stage unit.

Selecting Centrifugal Feed Pump

There are many types of centrifugal pumps when those of the various manufacturers are considered. They may, however, be classed in two main groups—the "volute" and the "turbine" pumps. The chief difference is that in the turbine type diffusion vanes are provided, through which the water must pass, while in the volute type a whirlpool chamber is used. The turbine pump is so called because of its circular casing, while the volute design has a spiral casing.

The mechanical details involved in the construction of the various makes of pumps have resulted in independent features. On the whole, when high-grade pumps are considered, there is very little choice left as to type, since the working efficiencies are practically equal. For large size pumps, impellers with a double water entrance have been found advantageous, whether of the open or closed pattern. This is necessary for hydraulic balance, and pumps so constructed are commonly called "double-suction" centrifugals. With such pumps two suction inlets may be used, although it is common to provide only one connection.

For total heads, not in excess of 150 ft., single-stage pumps may be used. For greater heads the pumps are compounded, being arranged for series operation, so that the discharge from one impeller becomes the suction of the next, and all are housed in one casing. Each stage is good for about 100 to 130 ft. head, and by multiplying the number of stages, a pump for any head may be built up. A four-stage centrifugal boiler feed pump of this type and driven by a steam turbine is shown in Fig. 2. The practical efficiency range of the centrifugal is from less than 50 to more than 70 per cent, according to capacity rating of the pump.

The characteristics of the centrifugal are such that the impellers required for any given service must be designed with suitable proportions for that service. Otherwise it will be difficult to meet the conditions and the operating efficiency will also be reduced. In the diagram, Fig. 3, are shown typical characteristic curves of a high-speed centrifugal pump suitable for motor or turbine drive. The performance curves are for a pump operating at constant speed, and the variations are all related to the normal rating, which is the most economic pump capacity. It will be noted that any change in head means a change in capacity, the capacity increasing as the head is reduced. The efficiency is maximum where the pump operates under rated conditions, and the normal full-load rating of the motor is utilized at this point. This is because the capacity and head of a centrifugal have a fixed relation.

In tracing the pump characteristics as shown by the curves in Fig. 3, it should be borne in mind that the

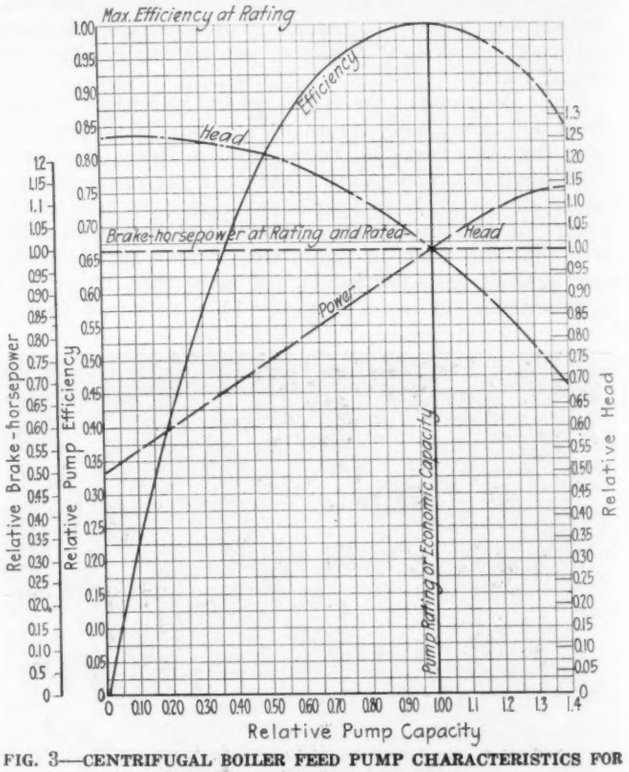


FIG. 3—CENTRIFUGAL BOILER FEED PUMP CHARACTERISTICS FOR OPERATION AT CONSTANT SPEED

power curve represents the brake-horsepower required to maintain the pump speed constant with increase in capacity. The starting point is at zero capacity. With the discharge valve closed, the pump does no useful work, but merely revolves the water within itself, and the pressure thus generated or the equivalent head is even slightly in excess of the actual total or rated head. When the valve is opened and the capacity increased, the power consumed becomes greater and the efficiency is also increased, for the friction and internal losses are reduced. When the pump rating or economical capacity is reached, the pump operates against the rated head and consumes the power applied at a maximum efficiency. As the delivery of the pump is increased above its rating, the developed head is gradually decreased, likewise the efficiency, and consequently a little more power is consumed. It is therefore realized that considerable importance is attached to a careful determination of the exact operating conditions when selecting a centrifugal pump for any specified installation. The main considerations are the head and capacity.

Power Requirements

For boiler feed service the size of centrifugal pump required may be determined from the formula G. P. M.

=boiler-horsepower × 0.06. The total head against which the pump is to operate must be carefully determined. It is made up of five factors—suction lift, discharge head, pressure pumped against, pipe friction, and velocity head. If the temperature of the feed water to be handled by the pump exceeds 115 deg. Fahr., it should be fed by gravity, as difficulty will be experienced in raising the hot water by pump suction. In such case the pump would be operating under a suction head, and the distance from the water level to the center of the pump should be deducted from the total to arrive at the normal head. The discharge head is the vertical distance between the center line of the pump and the level to which the water is delivered. The pressure is usually the boiler steam pressure in pounds per square inch, which multiplied by 2.3 gives the equivalent feet.

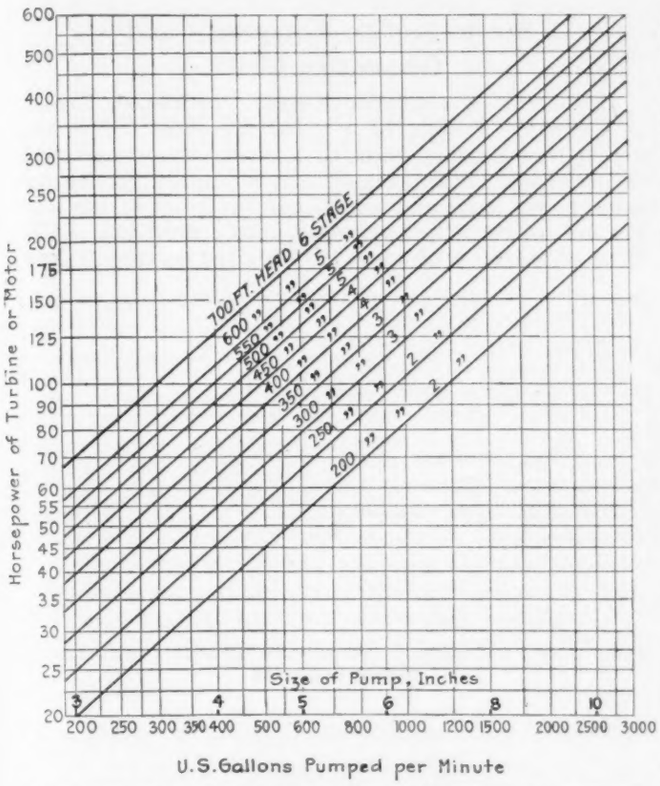

Horsepower of Turbine or Motor
700 FT. HEAD 6 STAGE
600 " 5 "
550 " 5 "
500 " 5 "
450 " 4 "
400 " 4 "
350 " 3 "
300 " 3 "
250 " 2 "
200 " 2 "
Size of Pump, Inches
U.S.Gallons Pumped per Minute

FIG. 4—DIAGRAM THAT SHOWS POWER REQUIRED TO OPERATE CENTRIFUGAL PUMPS

The friction head is determined from the size and length of piping with its number of elbows and the water handled. In pumping through a feed water heater, the friction in the heating coils must also be added. The velocity head in a well-designed system will range between 1.5 ft. and 2.5 ft., and is equal to the square of the velocity in feet per second at the pump nozzle divided by 64.4.

Having determined the normal head and capacity of the pump, the next step is to find the size of motor or steam turbine required for driving it. The efficiency of the centrifugal unit depends on its rating, and this variable must be taken into consideration. In the diagram of Fig. 4 the sizes of motor and turbine are given for different conditions of combined normal head and capacity. These sizes are proportioned on the variable efficiency corresponding to rated capacity. The driving unit may thus be selected without computation. The diagonal lines represent the normal head, including friction, and range from 200 to 700 ft. Alongside the head marked is given the number of stages the pump should consist of to operate against it.

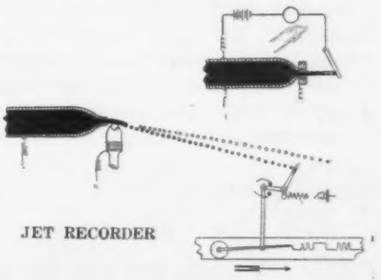
Centrifugal pumps are usually rated on the delivery in U. S. gallons per minute, which corresponds to a discharge velocity of 10 to 12 ft. per second. This gives a basis for a size rating and centrifugals are, therefore, commonly designated by the diameter of the discharge nozzle. The sizes from 3 in. to 10 in. corresponding to the normal capacity are also given on the bottom scale of Fig. 4.

By the use of this diagram for a given condition, the size and number of stages of the pump and the horsepower of the driving unit may be determined directly. In plotting these values for convenient reference, the guarantees offered by manufacturers, test results and actual installations were included in the considerations. The average performance of a number of pumps of different makes was determined, and thus the values represent fair commercial practice.

In using the diagram, find the capacity on the lower scale, then for a condition of 1000 gal. per minute against a total head of 350 ft., the following is found: Above the capacity a 6-in. pump is indicated, and following to the line of head gives three stages. By reading from this point of intersection to the power scale 145 brake-horsepower is shown as the required rating of driving unit. The nearest commercial size above this would be installed, which means a 150-hp. electric motor or steam turbine.

Surface Tension Jet Recorder

Valdemar Poulsen, the Danish scientist, has evolved an instrument, the action of which is based essentially on the alteration of the surface tension of a mercury jet by direct, alternating or even high-frequency current. In patent No. 1,198,270 two applications of the principle are shown. In one the current in the signal circuit causes the mercury jet to be deflected and in the other the jet is differentially broken up into separate globules by the current, and thereby is made to operate a relay in accordance with the received impulse. The apparatus consists of a jet of liquid (strong or weak electrolyte or preferably mercury or a liquid metal alloy), which while it is still coherent and not dissolved into separate drops, is in contact with a substance which forms with it a system consisting of an electrolyte and an electrode, through which the signal currents are led by means of another electrode. In one form, a tube of glass or iron, in which is found mercury, under suitable pressure produces a jet only a fractional part of a millimeter in diameter. The still coherent part of the jet touches a piece of glass which is partly encompassed by a body of porous nature, kept moistened with a solution of caustic potash. Around the body is wound a platinum wire serving as a conductor and at the same time acting as the one electrode, the mercury jet forming the other. As soon as an alteration in the potential difference between the wire and the mercury arises owing to the signal currents, the coherent part of the mercury jet is altered so that the jet is bent aside. In a modified form the lower end of the tube has a moistened ring-shaped piece of bone arranged about it. Each signal current in the signal circuit causes the coherent part of the jet to vary its length. Thus, during the passage of signal currents through the signal circuit, the jet and the contact will alternately open and close the local circuit in which the latter is interposed.



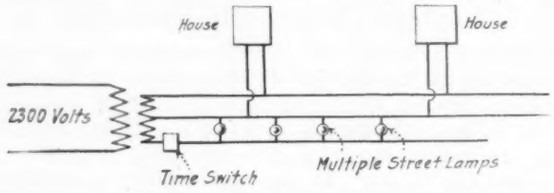
JET RECORDER

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Village Street Lighting from Three-Wire Lighting Transformers

Village street lighting in scattered rural districts is now being economically handled by the Cumberland County Power & Light Company of Portland, Me., by the use of three-wire distribution from commercial lighting transformers. As shown in the accompanying diagram, 120-volt multiple incandescent lamps, usually rated at 40 watts each, are connected between one side of the line and the neutral, a time switch being installed between the transformer secondary and the lamps. This arrangement enables street lighting to be supplied with minimum investment considerably below series distribution cost. A No. 6 wire suffices for the multiple street lighting feed, and the same fixtures can be employed later in series service when the growth of



METHOD OF CONNECTING STREET LAMPS TO THREE-WIRE LIGHTING TRANSFORMER

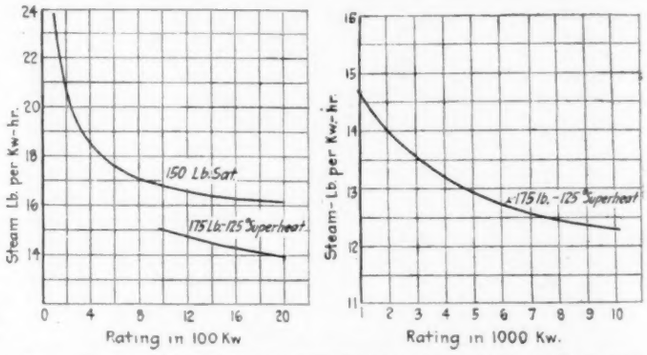
the load warrants such. A first-class time switch such as employed costs around $40, and the saving in long series feeds from one village to another is so large that a class of business formerly regarded as impracticable financially in many cases is now made attractive. About eighty lamps are in service in scattered street lighting installations in the villages of Sebago Lake, Standish, West Buxton and Hollis, Me., and the supply of even four or six street lamps from a commercial lighting transformer is reported profitable under the foregoing arrangement.

A Simple Test for Moisture in Transformer Oil

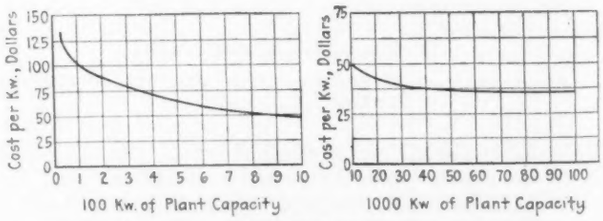
While the only thorough test for suitability of oil for transformers and oil switches can be made with high-tension testing apparatus, very good indications of the presence of moisture have been obtained by J. K. Mackie, superintendent of the Connecticut Power Company, as follows: A sample of the oil to be tested is drawn from the bottom of the transformer, oil switch or storage tank. (Samples from the upper parts of the tank are not considered as suitable for the test as water is heavier than oil and usually collects at the bottom.) In the sample thus taken is placed powdered anhydrous copper sulphate. If moisture is present the copper sulphate will be dissolved, producing a blue color that will diffuse through the oil if moisture is in suspension. Since enough copper sulphate is added to insure a saturated solution, the intensity of the blue tint will be a measure of the amount of moisture present. As small percentages of moisture have a very deleterious effect on the dielectric strength of oil, however, the lightest shade of blue is sufficient indication that the oil should be dried by filtering. It may be pointed out that other substances giving a deeper tint than copper sulphate may be used, the only requirement being that they dissolve quickly in water but not in oil.

Steam Station Equipment and Generating Costs

David Elwell, electrical engineer, Lockwood, Greene & Company, Boston, in a paper presented before the recent New England N. E. L. A. convention summarized the economic advantages of central station service for large power users and emphasized the effect of low cost per unit of capacity and output upon competitive conditions of energy production. He advised central stations



FIGS. 1 AND 2—STEAM CONSUMPTION OF SMALL AND LARGE STEAM TURBINES



FIGS. 3 AND 4—VARIATION OF EQUIPMENT COST WITH PLANT RATING

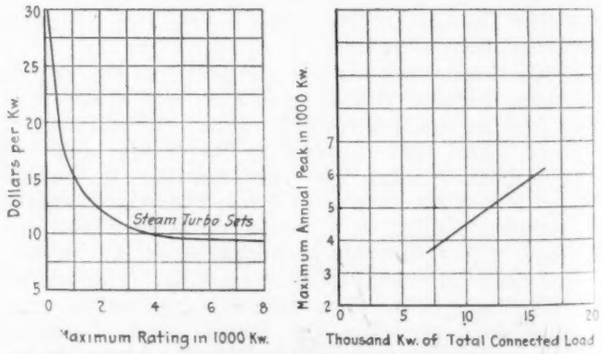

Dollars per Kw.
Steam Turbo Sets
Maximum Rating in 1000 Kw.
Maximum Annual Peak in 1000 Kw.
Thousand Kw. of Total Connected Load

FIG. 5—COST OF HIGH PRESSURE STEAM TURBINE SETS DELIVERED ON FOUNDATIONS; FIG. 6—VARIATION IN ANNUAL PEAK WITH INCREASE IN CONNECTED LOAD FOR MODERATE-SIZED PLANTS

dealing with difficult power situations to make rates based upon their own costs and thus be able to deliver energy at less than the private power plant.

For demands up to about 200 kw. he explained that the cost of privately generated power so exceeds that

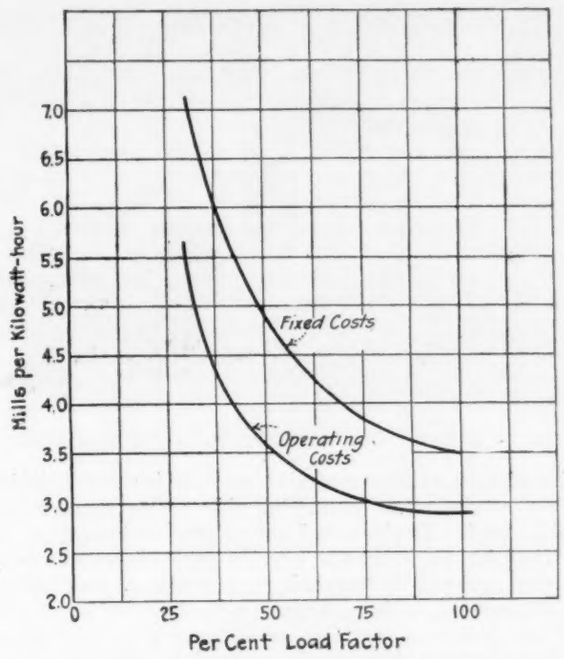


FIG. 7—RELATION BETWEEN COST OF PRODUCTION AND LOAD-FACTOR IN A SMALL PLANT

of purchased power at equitable rates that there is no chance for argument against the latter, assuming the existence of no important steam or power requirements outside those for electrical generation. The well-known advantages of diversified load were discussed at length in the paper, and the curves shown in Figs. 1 to 7 presented, which give relations between cost, capacity, load factor and the like under average operating conditions.

Construction of Power Lines for Western Logging Service

The problem of getting power to the point of service in a Western logging camp is often an important one in planning an electric logging installation. While this use of electric power is still new, special interest attaches to the cost of such work. Some of the more common problems, together with cost data, were presented in a paper by Allen E. Ransom presented before the recent Pacific Logging Congress. The probable power requirement of a two-engine logging camp is estimated as follows: Two electric donkeys, 300 hp.; blacksmith shop, 10 hp.; camp lighting installation, 5 hp.; portable compressed air plant, 15 hp.; heating and cooking (possible with cheap power), 30 hp.; total demand, 360 hp.

All of this load is seldom on at one time, so that the rating of the transformer station or mill plant available for use at the camp may be taken as 300 hp., or on the basis of 1 kw. at the generating or substation plant for each horsepower used at the camp. A transformer rating of 300 kw. in three 100-kw. units is recommended. The voltage used on the donkeys is generally 440, and the transformers can be provided with taps for either 220 or 110 volts for the other requirements of the camp. The following sizes of line conductors Mr. Ransom has found to apply to a camp of 300 kw. where the loss in power in the installations can be kept below 10 per cent:

SIZES OF LINE CONDUCTORS TO SERVE 300-KW. LOGGING INSTALLATIONS

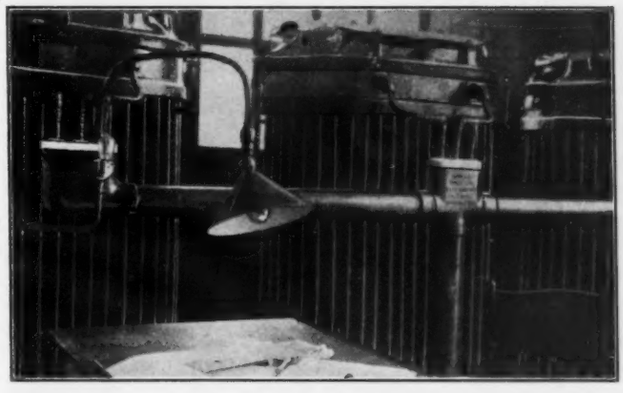
Distance from Source of Power	Voltage at Camp Transformer	Size of Copper Wires	Weight of Wire Per 1000 Ft. (Single)
4 to 6 miles	2,200	No. 2	200 lb.
8 to 10 miles	6,600	No. 4	126 lb.
12 to 15 miles	13,200	No. 6	80 lb.
20 to 25 miles	22,000	No. 6	80 lb.

The line separations for the voltages specified should be as follows: 220 volts, 18 in.; 6600 volts, 24 in.; 13,200 volts, 30 in.; 22,000 volts, 36 in. The length of spans will be determined by the country traversed, but with copper wire of the sizes specified 175 ft. does not require too much sag if 35-ft. poles are used and set 6 ft. in the ground.

The cost of transmission line for a 300-kw. installation would be approximately $10.05 per pole, or $351.75 per mile, which does not include engineering and clearing expenses nor cost of right-of-way. Owing to the unsettled market the cost of wire cannot be accurately estimated. Due to the high cost of copper a W-BB grade of galvanized iron telegraph wire is sometimes used, but owing to its high resistance and low conductivity as compared to copper (16 to 1), Mr. Ransom points out that care must be exercised in using it. Aluminum and duplex metal copper-clad steel wire are used to some extent, but copper has been found to be the best conductor and can be taken down and restrung on a new line without serious damage. Upon change of location the material used on a line built as above mentioned can be removed and a salvage value of $600 to $1,000 per mile realized on the original cost.

Special Outlets in Conduit Containing Transformer Circuits

The conduit wiring for transformers as shown in the accompanying illustration is a feature of the South Deerfield (Mass.) substation of the Greenfield Electric Light & Power Company. The installation consists of three 100-kva. General Electric oil-cooled units, delivering current at 4600 volts for local distribution and receiving 13,200-volt energy from the Greenfield com-



RECEPTACLE IN CONDULET FOR PILOT LAMP AND CONNECTION FOR OPERATOR'S DESK LAMP

pany's local transmission network. Both primary and secondary leads are wired in pipe duct, with "condulet" fittings, the arrangement providing an unusually compact installation. A special feature is the provision of an outlet in one of the "condulets" over the operator's desk to carry a lamp feed from the substation lighting circuit supply. The outlet also carries a receptacle

holding a 10-watt lamp which serves as a pilot when the station is otherwise darkened for that portion of the night after a railway motor-generator set in the room has been shut down. A swinging lamp bracket over the desk is threaded into the outlet for convenient handling and the provision of a metal reflector and 40-watt lamp enables the operator to read the watt-hour meter installation on the switchboard 12 ft. away without carrying portable unit about the substation.

ELECTRIC MANHOLE PUMPS AND VENTILATORS

Motor-Driven Apparatus Used by New York Edison Company Underground Department Where Hand-Operated Types Are Impracticable

In the accompanying illustrations are shown motor-driven blower and pump units used by the New York Edison Company when manholes or underground vaults in lower Manhattan island collect water after a hard rainstorm or fill up with steam or gas escaping from leaky mains. In other cases they make it possible for men to work in manholes when the heat or humidity of the air would otherwise be unbearable. Usually these machines can be energized from near-by lampposts or junction boxes accessible through handholes.

RATINGS OF MANHOLE PUMPS USED BY NEW YORK EDISON COMPANY

Horsepower	Weight	Maker of		R.P.M.	Volts	Amperes	Suction (In.)	Discharge (In.)	Gal. per Min.	Approx. Lift (Ft.)
		Pump	Motor							
10	2600	Lawrence	General Electric	675	230	37	5	4	360	15
...	....	Lawrence	General Electric	815	234	28	5	4	340	15
5	1400	Gould	Westinghouse	740	115	39	4	3	200	15
3	785	Gould	Fairbanks-Morse	1200	240	...	3	3	120	13.5
2	....	Lawrence	Fairbanks-Morse	1200	240	...	2	1.5	110	13.5

Approximate height of discharge for 3-hp. pump is 36 ft. for lift of 13 ft. and that of 2-hp pump is 26 ft. with lift of 13 ft.

The blowers are mounted in boxes which may be lifted by one man and are transported on trucks. In the wall of the box opposite the blower suction is a hole covered with a screen. The discharge terminates outside the box where a screw connection can be made with a hose leading down into the manhole to be ventilated. The motor control and main cutout switch are mounted on the lower side of the box lid so everything is inclosed when the cover is closed. For general use ¼-hp. motors with direct-connected fans are used. Inclosed in a hardwood box with the previously mentioned auxiliaries the sets weigh about 25 lb. each.

FIG. 1—MOTOR-DRIVEN BLOWER VENTILATING A MANHOLE

Most of the pump sets are made of two separable units, so that they can be moved into places which would be inaccessible if the units were permanently connected. This arrangement is considered necessary because it is sometimes advisable to lower the equipment below the street level to reduce the suction head. Connecting the motor and pump by a coupling and cutting the bed plate in two sections has permitted this. The suction hose used is made of reinforced non-collapsible material.

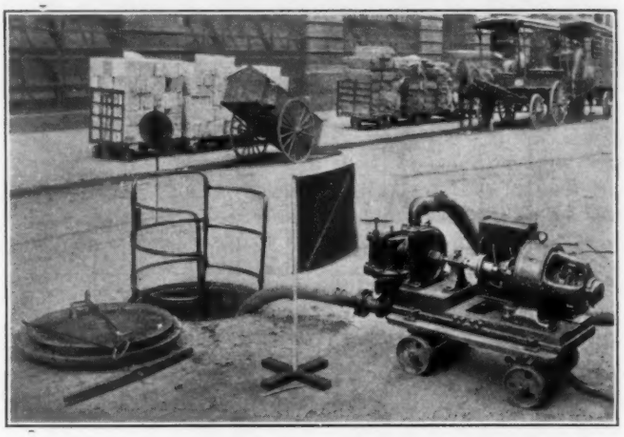


FIG. 2—PUMPING OUT MANHOLE WITH PORTABLE UNIT

The pumping units are kept in various district headquarters subject to the call of customers, contractors, department of water supply; also for the companies own protection of service connections and sub-surface sections. Quick delivery is assured by the use of the company's electric vehicles. When fires occur near substations where there is a possibility of water entering the stations through cable vaults, these units are sometimes useful to remove water that cannot be disposed of by the station pumps.

Cost of Electric Welding in Railroad Shop Repair Work

The accompanying data on repair costs due to electric arc welding have been compiled by the Westinghouse Electric & Manufacturing Company from the shop records of railroad companies. One railroad company which has kept continuous records of the savings made by arc welding reported that the total cost of welding by this process during one week was $106.62, while the total cost of the same work if done by other means would have been $1,779.04, representing a net saving of $1,672.42 in favor of arc welding. In addition a great saving in time was made. In another case, where an entire firebox had to be taken out, the work, including 35 ft. 7 in. of linear cutting, was done in thirty-eight minutes with approximately 500 amp.

RELATIVE COST OF ELECTRIC WELDING IN REPAIR WORK

Nature of Damage Repaired	Cost in Dollars with						
	Electric Arc Welding				Old Method		
	Energy	Labor	Material	Total	Labor	Material	Total
Cracked door sheet on fire box	0.09	0.30	0.12	0.51	30.00	24.00	54.00
Cracked side sheets and door sheets in fire boxes	.....	.....	.....	4.23	.....	.....	24.35
Cracked crown sheet	.....	1 hr.	.....	0.36	30 hr.	.....	75.00
Broken frame	.....	7 hr.	.....	3.29	12 hr.	.....	14.73
Worn wrist pin	0.10	0.75	0.15	1.00	.....	.....	35.00
Cracked steel bolsters	0.54	5.42	0.75	6.71	.....	.....	54.00
Cracked guide yoke	0.07	0.45	0.10	0.62	.....	.....	47.00
Cracked mud ring	0.27	1.95	0.37	2.59	16.20	13.00	48.20
Five draw-head stops	1.30	1.15	0.18	2.63	.....	.....	22.20
Broken cylinder	0.80	0.65	0.11	1.56	9.80	4.00	13.85

OVERHAULING TURBINE UNIT AND ITS AUXILIARIES

Dismantling and Inspecting Equipment, Installing New Condenser Tubes, Cleaning Old Ones, and Increasing Circulating Pump Capacity

Recently the Commonwealth Edison Company overhauled a 35,000-kva. turbo-generator which has been in service in its Northwest station for about one year. Although examination of the turbine blading was the principal reason for "shutting down" the unit, advantage was taken of this opportunity to install condenser tubes which had been intentionally left out for experimental purposes when the machine was erected. At the same time the turbine, generator and condenser were cleaned and changes made in the circulating pump. By thus performing several operations at the same time the company obviated the necessity of keeping its most efficient machine off the system as long as would be required if the various operations were undertaken at different times. By systematically preparing for the work and keeping men constantly on the job, the task was completed in seventy-eight and one-half hours.

The workmen were divided into three crews—one for turbine work, one for condenser work and one for work on the auxiliaries. Six men were engaged in each of these divisions working on twelve-hour shifts. Part of these men were supplied by the manufacturers of the turbine and the condenser; some of them were journeymen machinists, and others were recruited from the ranks of the Edison company. In addition to these men, who gave their time exclusively to taking down the turbine and its auxiliaries and putting them together again, some members of the operating force were used to clean the condenser tubes and generator.

The biggest item in the preparation was securing tools, especially wrenches, in sufficient numbers. Before the machine was stopped three sets of wrenches of almost every size needed, and as many as from twelve to eighteen wrenches of the more commonly-needed sizes, were arranged where they could be conveniently found on the turbine-room floor. Men who had watched the erection of the unit were also present in an executive capacity, since they knew how the erectors had handled each piece with the greatest ease.

When the machine came to rest, about ten minutes after it was taken off the line, the men set to work without waiting for it to cool, gloves being used to protect their hands. The turbine crew removed lagging from the casing of high-pressure cylinders, "broke" the main steam connection, took off the admission valve, removed the governor and its rigging, took off the oil pump, and disconnected all water and oil connections. Nuts, bolts and parts which might be misplaced were laid on the floor at the side of the turbine in the same relative position they occupied when installed, to facilitate locating them later during erection. While the parts were lying on the floor they were cleaned and made ready for reassembling. The oil had been previously drained into the filter, so all oil and water pipes were blown out with compressed air. The casing of the low-pressure cylinder was not removed. Instead, the manholes in the steam belt were opened, and arrangements were made for getting into the exhaust chamber of the unit just beneath the low-pressure cylinder.

With the machine in this condition it was possible to thoroughly inspect all blades, wheels and diaphragms. The rotor was turned by attaching a hook to one of the spokes of a hand wheel fastened to the shaft and pulling the hook with the crane. Several men were stationed along the frame to watch the high-pressure blades. The low-pressure blading was inspected from the manholes in the steam belt and from the exhaust chamber. This inspection showed all parts of the turbine to be in practically as good condition as when they were installed.

Work on the condenser was carried on simultaneously with that on the turbine. From a platform previously erected at the level of the second pass of the condenser men took off the manhole covers, entered the unit and unscrewed the plugs from the tube holes that were to be filled. While this was being done the upper half of the water-box cover was removed. Eight hundred 16.5-ft. by 1-in. brass tubes were then inserted in the tube sheets of the second pass. When all of the tubes were in place the ends were packed. It was not necessary to wait for the completion of the packing operation, however, to replace the heavy water-box covers, because with the tubes once in place the packing could be accomplished by men inside the condenser. This method of procedure allowed the condenser men, whose job required a long time, to continue to work up to within a few minutes of the time the unit was to be started.

While the new tubes were being inserted those already in place were cleaned. The method of cleaning was unusual. For this work disks were cut from 0.25-in. canvas belting and six-penny nails were driven through the centers of the disks. The diameter of the disks was made equal to the inside diameter of the tubes. After the disks were inserted in the tubes by hand a compressed-air nozzle was used to drive them the full length of the tube. The disks were maintained in practically the correct position with respect to the tubes by the nails. When they came out at the other end, carrying the dirt with them, another workman picked them up and returned them to the "air-gun" operator. This proved a very effective method of removing all slime from the tubes, but it is too slow for use under operating conditions.

Since the circulating water used is virtually sewage it was believed by the company's engineers that more-rapidly-moving water would deposit less lime on the tubes. Furthermore, use of more water and cleaner tubes would give a higher vacuum. Consequently, changes were made to increase the output of the circulating pump. The unit on which the changes were made consists of a 52,000-gal.-per-minute circulating pump and a turbo-air and wet vacuum pump both driven by a 500-hp. two-stage turbine. To get the desired result it was necessary to increase the nozzle area of the 500-hp. turbine and to place larger internal parts in the circulating pump. During this work it was important that the 110-ton station crane should not be required for lifting at the same time it was needed on the main turbine. This was obviated as follows: The top half of the circulating pump was taken off, while the air and wet pump was dismantled from the end. A "lift" was then made on the 500-hp. turbine casing to permit the nozzle change. Later the impeller, its casing and the shaft of the circulating pump were removed and replaced by larger ones. The auxiliaries were also found to be in good condition.

While the dismantling and reassembling of the steam system of the machine was in progress, men from the electrical section of the station operating force opened the inner and outer casings on both ends of the generator. With the end coils and ends of the rotor exposed the small amount of accumulated dust was blown out. The brushes were also taken from the holders, but only required "touching up."

The work outlined was directed and inspections were made for the Commonwealth Edison Company by F. M. Lynch, chief engineer of the Northwest station, and by Edward Gilroy, assistant to the chief engineer.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

BOSTON EDISON SOLD 1019 ELECTRIC RANGES IN ONE YEAR

Propose Doubling Range Sales in 1917—Data from Range Installations in Boston and Other Cities Having Special Cooking Rates

During the year ended Oct. 31 the Edison Electric Illuminating Company of Boston sold 1019 electric ranges. A combined "experience" and "booster" meeting was held at the Engineers' Club in Boston on Nov. 1 to celebrate the event. One year ago the company's officials and its employees in the appliance and sales departments set themselves the task of selling 1000 ranges in twelve months. The campaign has attracted nation-wide attention and the beating of "bogie" by nineteen brought enthusiastic congratulations from all over the country.

Before the booster meeting closed the 128 men and fifteen women most directly interested in the campaign voted, amid enthusiastic applause and hearty cheering, to sell at least 2000 ranges during the coming year.

It was estimated at the beginning of last year's campaign that the 1000 ranges would give a total connected load of 4000 kw. Early in the campaign it was seen that the ranges were averaging larger in capacity, and the close of the first year of the campaign showed an estimated connected load of 5225 kw. for the 1019 ranges, a very satisfactory "over-run" of the estimate.

ONE RANGE PER 1000 OF BOSTON'S POPULATION

W. H. Atkins, general superintendent, in reviewing the features of the campaign, gave some interesting information regarding electric range campaigns in other parts of the country, received in response to telegrams sent to twenty-three central stations having special rates for cooking. From the replies received Mr. Atkins read for comparison data from companies whose rates per kilowatt-hour for 100 kw.-hr. per month are less than that of the Boston company.

"The Edison Company of Boston, with a population of approximately 1,180,000 in its territory," said Mr. Atkins, "has sold or already installed on its lines about 1200 electric ranges, more than 1000 of which have been sold during the period of the last year, the average rate per kilowatt-hour for 100 kw.-hr. per month (taken as a basis) being 2.8 cents per kilowatt-hour. This means one range for every 1000 of population.

"In a Western city, with a rate of 2.7 cents per kilowatt-hour and a population of 260,000, they have 1194 electric ranges installed, or 4.6 ranges for every 1000 of population.

DATA FROM OTHER CITIES

"In San Francisco the Pacific Gas & Electric Company has a cooking rate of 2.6 cents per kilowatt-hour and a population of 1,000,000, but it has no records of the number of ranges, while the Great Western Power Company, however, which operates in the same territory, claims 1000 ranges, and although these two figures cannot be used in the same relation with others, they are included for the sake of comparison. The ranges in San Francisco computed from the above figures would equal one to every 1000 of population.

"An Ohio city, with a population of 125,000 and a rate of 2.5 cents, has 160 ranges, or 1.3 ranges per 1000 of population.

"A Far West city, with a rate of 2.48 cents and a population of 25,000, has 298 ranges, or twelve ranges for every 1000 population.

"Other cities report as follows:

City	Rate per 100 Kw.-Hr. per Month	Number of Ranges	Population	Ranges per 1000 Population
City No. 1.....	2.4 cents	35	100,000	0.3
City No. 2.....	2.06 cents	700	600,000	0.8
City No. 3.....	2 cents	60	60,000	1.0
City No. 4.....	1.64 cents	50	12,500	2.0

"The time element enters into the above figures, as most of the companies named have had their low cooking rate and have been pushing the sale of electric ranges much longer than our own company; consequently the number of ranges per 1000 of population sold during the last year would probably be larger in Boston than in any of the other cities quoted above. It is also quite probable that Greater Boston has a larger number of electric ranges installed and sold than any other city of the same population in the country."

AVERAGE BILLS OF BOSTON ELECTRIC-RANGE USERS

C. E. Greenwood, superintendent of the appliance department, who followed Mr. Atkins, referred to the cost of electric cooking in apartment houses, giving the following data on monthly bills:

Beacon Apartments, small suites, with ranges of the kitchenette type with an average of fifty bills.....	$1.60
Gilbert Apartments, six and seven-room suites, housekeeping with maids, average of fifty bills.....	3.12
Colonna Apartments, three and four rooms, kitchenette type of range, average of fifty bills.....	2.61
The average of ten private houses with sixty-eight bills.....	4.67

S. W. Wilson of the range division spoke of the different questions prospective customers asked. The first one usually is, "What does it cost to operate an electric range?" From experience, Mr. Wilson estimates the cost from 80 cents to $1 per person per month on the Boston Edison cooking rate, but said that some customers found the rate much less. The second question usually raised by the prospect is the meaning of "watts" and "kilowatts." Another question is, "Isn't it much slower to cook by electricity than by gas?" This question, Mr. Wilson said, could best be answered by experience, and whatever small "time element" there is, is more than offset by economies and by taking advantage of the stored heat. Mr. Wilson said that in some cases he had "grabbed opportunity by the forelock" and installed ranges on trial with the understanding that at the end of sixty or thirty days if the range did not prove satisfactory the company would take it back. He had never had a range returned on these conditions.

J. W. Cowles, superintendent of the installations department, spoke of the service the installation men render customers, and described the system for taking care of any troubles that may arise. The men in his department who are expected to look after any troubles of this kind appreciate the importance of returning a

range to service as quickly as possible. Every method available has been adopted to give quick, remedial service. A special man has been assigned to look after this kind of work. The Boston Edison Company does not forget, however, that much of the responsibility must rest with the manufacturers, who are held to strict account if any construction difficulties arise.

ADVERTISING THE RANGE CAMPAIGN IN BOSTON

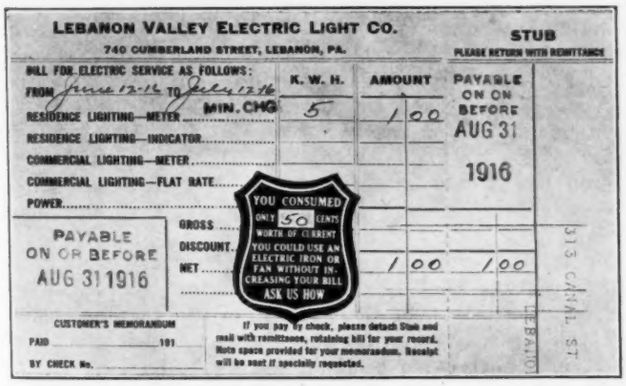
L. D. Gibbs, superintendent of the advertising department, spoke of what his department has endeavored to do in arousing interest among fresh prospects and in giving them information in advance of the calls by representatives of the appliance department. He said the aim of the advertising department is always to emphasize honestly and completely, but without exaggeration, the big selling points in favor of electric cooking, viz.: simplicity, convenience, superexcellence of results and economy in use. Advertising should be in the nature of an advance agent, making easy the approach and in a measure carrying the introduction of the salesman to follow. He emphasized the importance of the easy-payment plan, explaining that if the convenience of this plan is properly presented almost no prospect would refuse the opportunity to buy an electric range.

R. S. Hale, superintendent of the special research department, proposed an electric kitchen in which separate electric cookers would be used to prepare different foods, thus attaining greater convenience and insuring superior flavor.

Encouraging the Customer to Use the Full Amount of His Minimum

The Edison Electric Illuminating Company of Lebanon, Pa., encourages its customers who do not use up their monthly minimum charge to purchase electrical appliances to increase their bills to the full amount of the minimum. A. L. Scott, sales manager of the company, recently hit upon a scheme of placing a label on the bill, as illustrated.

"After using these labels for the last five months," says Mr. Scott, "we find from our records that we do not use as many labels in two months as we formerly did in one month. There is, moreover, hardly a case


LEBANON VALLEY ELECTRIC LIGHT CO.
740 CUMBERLAND STREET, LEBANON, PA.
STUB
PLEASE RETURN WITH REMITTANCE
BILL FOR ELECTRIC SERVICE AS FOLLOWS:
FROM June 17-16 TO July 17-16
K. W. H. | AMOUNT | PAYABLE ON OR BEFORE
MIN. CHG 5 1 00 AUG 31
RESIDENCE LIGHTING—METER
RESIDENCE LIGHTING—INDICATOR
COMMERCIAL LIGHTING—METER
COMMERCIAL LIGHTING—FLAT RATE
POWER
1916
YOU CONSUMED ONLY 50 CENTS WORTH OF CURRENT YOU COULD USE AN ELECTRIC IRON OR FAN WITHOUT INCREASING YOUR BILL ASK US HOW
PAYABLE ON OR BEFORE AUG 31 1916
GROSS
DISCOUNT
NET 1 00 1 00
CUSTOMER'S MEMORANDUM
PAID 191
BY CHECK No.
If you pay by check, please detach Stub and mail with remittance, retaining bill for your record. Note space provided for your memorandum. Receipt will be sent if specially requested.
513 CANAL ST
LEBANON

THE RED STICKER SHOWN IS AFFIXED TO BILLS OF CUSTOMERS WHOSE ENERGY CONSUMPTION TOTALS LESS THAN THE MINIMUM CHANGE

where we need employ the label twice on one customer. The use of the label has also increased our merchandise sales.

"During our first month's use of these stickers it was necessary to employ approximately 125. We have 1600 resident consumers. The next month the number used decreased approximately 25 per cent, and in three months only half as many were being used.

"We first used these stickers on our June bills—that is, bills covering the period from May 1 to June 1. Our merchandise sales increased, and during these three months we sold approximately 350 irons. Not all the credit was due to the stickers, of course, but we can credit at least 10 per cent, and in a good many cases the people purchased larger lamps so as to take advantage of the current which was possible for them to use without additional charge. Our meter reader reports that during the course of reading meters the people who received a bill who had not been using the amount of the minimum charge made very favorable comments concerning the policy of the company in advising their customers on matters with which they were not any too familiar."

Encouraging Power Customers to Advertise Their Businesses

The Texas Power & Light Company is now furnishing electric power for approximately 100 cotton gins in its territory in North Texas, and during the past year has been doing a considerable amount of work with the object of persuading these gins to advertise their business. The idea was started last year when the cotton crop was short, the object being to increase the number of bales of cotton ginned at the electric gins and incidentally to increase the company's power revenue from this source.

SIGN ADVERTISING THE EVER-READY ELECTRIC COTTON GIN

A number of these gins have already responded to the work which has been done mostly by means of direct-by-mail advertising. The accompanying illustration shows one of a number of road signs placed by one electric-gin operator on the roads leading into the town. It is of interest that this gin has already ginned over 4000 bales of cotton this season, whereas the number for the average gin is only slightly over 1000 bales.

Six Best Reasons for Wiring the House

Six best reasons for wiring old houses for electric light are set forth in the current advertising of the Louisville Gas & Electric Company as follows:

1. Money invested in house wiring pays 25 per cent.
2. Wired houses sell for more. Homeseekers want modern conveniences.
3. Electric wiring is "tenant insurance."
4. Electric service is economical.
5. Electric light is convenient.
6. Electric light lessens fire hazard.

These reasons, according to the Louisville company, have proved most effective in the wiring campaigns conducted by it during the past thirty months, when 11,000 old houses have been wired.

In the present slogan contest being advertised in the local papers these six reasons are grouped in a box so as to give contestants suggestions for a slogan which the company will select as a result of the contest now on. The contest is open only to persons who live in unwired houses, and the purpose is, of course, to get them interested in the advantages of electricity for domestic purposes.

Real Estate Flood-Lighting That Rented Apartments and Sold the Buildings

Electric light, cleverly applied, helped a Kansas City realty firm to establish a record in the leasing of a block of forty-four apartments in thirty days.

The eight six-apartment buildings, each three stories in height, had been erected in three months, and Roy M. Gregg, manager for the property, made a six weeks' tour of the East last spring to gather ideas on flat management and marketing.

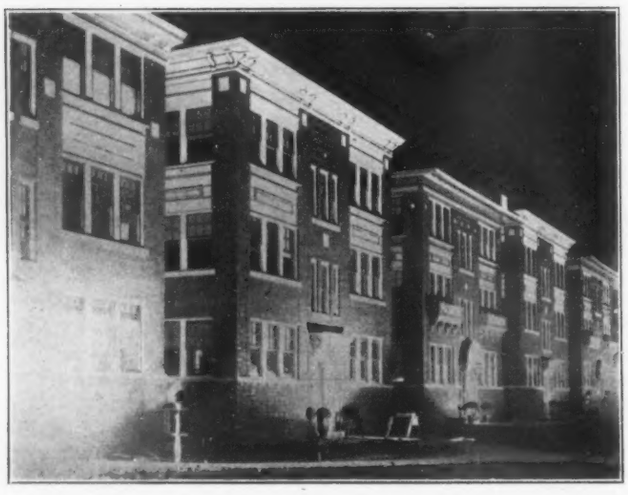
FLOOD LAMP

The big idea that Mr. Gregg brought back, however, was secured from the flood-lighting of office buildings, particularly the Woolworth Building, and on his return he assigned Peter La Pierre, electrical contractor for the builder, to the execution of this plan for renting the buildings by flood-lighting.

The result of the flood-lighting was almost instantaneous. One of the apartments was leased the first night; in the first two weeks twenty-seven were leased, and in three weeks thirty-five. In fact, all but a few of the flats on the side street were leased within the month. A count of automobiles passing on the boulevard was taken for several nights; an average of fifty automobiles passed the buildings every three minutes from 5.30 until 10.30 p. m. Every occupant observed the new flats, and was favorably impressed, and many cars were stopped. The salesmen took care of fifteen to fifty people every evening, practically all of whom had come in automobiles.

Except for lights in one or two of the hallways, all the buildings were dark inside. Many leases were closed on the first view of the visitors and people moved in at once.

There had been some fear that the spot-lighting of



FLOOD-LIGHTING RENTED FORTY-FOUR OF THESE APARTMENTS IN THIRTY DAYS

the buildings would annoy the occupants, as Mr. Gregg had planned to keep the lights on even after the flats were rented. He found, however, that the projectors did not disturb the tenants; that, in fact, they rather liked it, since it gave their homes distinction and brilliancy. Mr. Gregg is now working on a plan for a softer light than that used for exploiting the apartments, a concealed source, perhaps, which can be buried in the lawn, so that the light source will be completely hidden. The lamps used will be the same power as would be maintained in any event at the entrances, so there will be no additional cost.

Incidentally, it may be mentioned that three of these apartments were also sold during the thirty days, although flats usually aren't sold until after they have proved their earning capacity.

A Combination Suffrage-Electric Range Booth at a County Fair

During the recent Suffolk County Fair at Riverhead, N. Y., the Riverhead Electric Light Company co-operated with the local Woman Suffrage Club in an exhibit booth showing the electric range in use. Since the suf-

ENLISTING THE SUFFRAGISTS IN THE DEMONSTRATION OF ELECTRIC RANGES

frage booth was one of the centers of feminine interest at the fair, the electric ranges exhibited came in for their share of attention from the housewives present, and in consequence much valuable publicity for electric cooking was secured.

Central Stations Subscribe to the "Buy-an-Electric-Vehicle" Movement

At the recent Pittsfield, Mass., convention of the New England section of the N.E.L.A., E. S. Mansfield, chairman of the Electric Vehicle Section of the national body, said that in order to stimulate activity every Class A member is asked to purchase at least one electric vehicle for use or resale. President Herbert A. Wagner of the National Association has, for example, ordered twenty-five machines. Mr. Mansfield said that every central station should have at least one man specializing a part of his time at any rate in this field. Educational courses are planned for such employees. It is realized that the ordinary central station offers a comparatively poor transportation use factor for the electric vehicle, and that the fitness of such machines for service elsewhere should not be judged by intermittent requirements. The need of a lighter machine is apparent, and it is expected that one will shortly make its appearance. This the speaker said will be "practically a Ford with an electric heart."

Recent successful developments in the taxicab field are also notable, the average cost per car-mile being 18 cents for electric taxicab service against 33 cents for gasoline. As the average income per car-mile is not much over 35 cents, the sphere of the electric taxicab is evident. Companies will shortly be organized, according to present plans, in New York, Chicago, Philadelphia and Minneapolis to provide electric taxicab service.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

HEAT TREATMENT OF STEEL

The Influence of Heat Treatment on the Thermo-Electric Properties and Specific Resistance of Carbon Steels—Analogy Between Liquid and Solid Solutions

THE fundamental contribution of the new science of metallography to metallurgical knowledge may be summed up in the statement that chemical analysis is not everything. Two samples of a material may have identical chemical analysis, yet show different properties, and this difference in properties is the result of a difference in the previous history of the two samples (difference in heat treatment, mechanical working, etc.) which has caused a difference of structural constitution of the two samples as revealed by metallographic methods. The most interesting and industrially most momentous example of the possibilities of changing completely the properties of a metal by mechanical working and heat treatment is probably the process by which amorphous tungsten can be made ductile and which has resulted in the enormous improvement of the tungsten lamp.

At the recent meeting of the (British) Iron and Steel Institute in London an interesting paper was presented on the influence of heat treatment on the thermo-electric properties and specific resistance of carbon steels, the author being Prof. Edward D. Campbell of the University of Michigan. The paper gives the results of a large number of tests of carbon steels ranging from 0.018 to 1.05 per cent in carbon and differing little otherwise so that the results are comparable. The specific electric resistance of all these steels was measured and the thermo-electric force of the same steel bars joined at each end to pure iron leads was determined. The reason for this arrangement is that former experiments had shown that the total specific resistance of steel must be considered as made up of two components; first, that due to pure iron, and, second, that due to the carbides dissolved in the iron. It was expected (and the present investigation confirms this) that the thermo-electric force is likewise made up of two such components. In that case, by joining two pure iron leads to the two ends of the steel bars under test the thermo-electromotive potential of pure iron is opposed to that of steel, so that according to the theory indicated above the thermo-electromotive force measured would be that due to the solutes (carbides) alone.

The bars on which both specific resistance and thermo-electromotive force measurements were made were of the same size, and the method of heat treatment was as follows: The bars which had been previously carefully annealed were suspended in an electrically heated furnace for one hour, the furnace being so designed that the temperature could be accurately measured and oxidation of the bars completely prevented. When the bars had attained the temperature of the furnace they were quickly removed and quenched in ice water. After making specific resistance and thermo-electromotive force measurements on the quenched bars, these were placed for forty-eight hours in a drying oven maintained at a temperature between 97 deg. and 102 deg. C. After again measuring the specific resistance and thermo-electromotive force the bars were carefully packed in a steel tube, which was then placed in an electrically heated furnace and the temperature raised to 205 deg., at which it was maintained between one and two hours, after which the furnace was allowed to cool over night. The subsequent heat treatments at 309, 388, 495, 599, 696 and 800 deg. C. respectively were carried on in substantially the same manner as that for tempering at 205 deg. C. After each reheating followed by slow cooling measurements of both specific resistance and thermo-electromotive force were made.

As to the detailed results the reader must be referred to the tables and diagrams in the original paper. The

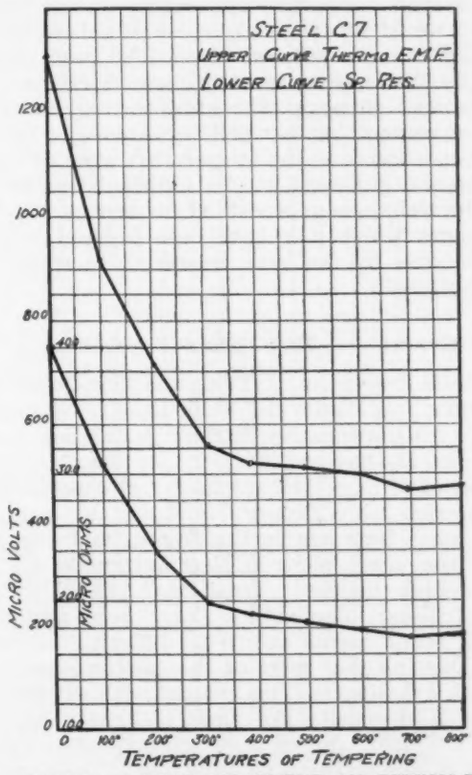


FIG. 1—EFFECT OF HEAT TREATMENT ON THERMO-EMF AND SPECIFIC RESISTANCE OF STEEL

results for the steel containing the highest carbon (1.05 per cent carbon, 0.190 manganese, 0.013 phosphorus, 0.020 sulphur and 0.167 silicon) are reproduced in Fig. 1. The chief results are as follows:

First, there is a distinct parallelism between the thermo-electromotive force and the specific resistance of the different steels, as influenced by chemical composition and heat treatment, and this would prove almost conclusively that the total thermo-electromotive potential of steel, like the total specific resistance, must be considered as being made up of two components: that due to the solvent iron and that due to the carbide solutes; the proportion of the total due to these latter depends upon the extent to which they are in solution. The parallelism is strong confirmatory evidence of the essential unity of mechanism of the nature of metallic and of aqueous salt solutions, for it is well known that

in the latter it is the molecules in solution (the ions of the salt) that are the most active energy transformers. In the present case we have transformation of electrical energy into heat, resulting in specific resistance, and transformation of thermal energy into electrical energy, resulting in thermo-electromotive force, both phenomena apparently being due to the same molecular condition.

The higher the carbon contents in the steel the greater the effect of heat treatment (on account of the larger amount of carbides brought into solution). But neither the specific resistance nor the thermo-electromotive force due to carbon in solution as carbides is directly proportional to the atomic concentration of the carbon.

The conception in regard to thermo-electromotive potential outlined above would suggest at least two applications of the principles involved. First, if constancy of thermo-electromotive force in couples is to be expected, it will be necessary that the molecular concentration in those members not consisting of strictly pure metals remains constant over the temperature range within which the couples are used.

The second suggestive application of the principles involved would be for the purpose of following up the molecular changes induced in steel by heat treatment. Since the thermo-electromotive force is independent of the size and shape of the cross-section between the points of contact, but is wholly dependent on the molecular composition and the temperature gradient between these points, it should not be a difficult matter to develop the technique of a method for testing the molecular changes which may have been induced in a given piece of steel by the heat treatment to which it has been subjected.

Generators, Motors and Transformers

Magnetic Properties of Cobalt and Iron-Cobalt Alloys.—HERBERT T. KALMUS and K. B. BLAKE.—An extended account of a continuation of their researches on cobalt, carried out at Queens University for the Canadian Department of Mines. The results are of especial interest in connection with Yensen's work on this subject described some time ago in the Digest, and suggest the use of iron-cobalt alloy in electromagnetic machinery requires high magnetic densities. The chief results are as follows: The authors have been able to cast Fe_2Co in sound ingots only with difficulty, microphotographs showing that most of the castings prepared by them lack cohesion and are crossed with extremely fine cracks. Mechanically the alloy is brittle, but fairly strong; annealed samples show approximately the same ultimate tensile strength as pure iron. The alloy Fe_2Co may be forged with considerable readiness, after which it has more than twice the strength of pure iron. The iron-cobalt alloy, Fe_2Co has a saturation value of magnetization from 10 per cent to 13 per cent higher than that of pure iron. No doubt the higher value is the more nearly correct one, as it is obtained from samples prepared in the vacuum furnace, which are substantially free from indications of lack of cohesion. The best castings show a maximum permeability of approximately 13,000 at a density of 8000 gauss. This is considerably lower than the corresponding value for pure iron, but much greater than that of standard transformer steel or other commercial materials. The most important magnetic property of the alloy Fe_2Co is its permeability in medium fields—that is, for magnetizing force of from 50 to 200 gilberts per centimeter. Through this range the permeability of Fe_2Co is approximately 25 per cent greater than that of pure iron, or of commercial grades of transformer steel or iron. The hysteresis loss of the alloy Fe_2Co is considerably less than for the best grades of commercial transformer steel at densities of 10,000 gauss, and about the same as for commercial iron at corresponding densities, at densities of about 15,000 gauss. Yensen has reported the specific electrical resistance of Fe_2Co to be about 10 microhms; that is, about the same as for pure iron. These magnetic properties of the alloy Fe_2Co should render it of great value in parts of electromagnetic machinery, where extreme magnetic densities are required.—*Canada Dept. of Mines, Mines Branch, Report* 413.

Induction Motor.—F. T. CHAPMAN.—The conclusion of his long mathematical paper on the air-gap field of the polyphase induction motor. The author gives oscillograms illustrating the theory given in former installments and summarizes his conclusions.—London *Electrician,* Oct. 6, 1916.

Transformer Design.—DAVID ROBERTSON.—The conclusion of his paper illustrated by diagrams on the mathematical design of transformers. The author gives a comparison of types, both single phase and polyphase being considered, and follows this up with a comparison of materials. Winding equations are next given and the best distribution of the losses is discussed. The author finally summarizes the advantages of the method which he has described in the article.—London *Electrician,* Oct. 6, 1916.

Installations, Systems and Appliances

Electric Water-Heating in the Household.—J. L. SHROYER.—A record of the results obtained in an extensive investigation of the various methods of heating water electrically for household use. A description is given of the three logical systems: the instantaneous, the intermittent storage, and the continuous storage. Each of these methods may be particularly suited for certain requirements. Therefore, the selection is governed by the service required, the cost of operation, and the initial installation cost. Considering the service only, the instantaneous method is preferable, the service being ideal when the heater is large enough to meet the maximum demands. The continuous storage method would be the next choice, and with the proper size heater and tank is practically as serviceable as the intermittent method for ordinary requirements. The intermittent method, with a 2-kw. to 4-kw. heater, requires the most attention. The demands for hot water must be anticipated and the heater turned on for a sufficient time to heat the water. It is shown that the time required to heat water by this method is too long to compare favorably with gas heating or to be satisfactory for average household requirements. This method is most applicable where considerable quantities of hot water are required at definite but infrequent intervals. At least a 20-kw. heater would be required for the instantaneous method. The load factor of such a heater would probably be less than 2 per cent, and the central stations would be obliged to charge a kilowatt-hour rate many times greater than that for a lower capacity heater operating at approximately 100 per cent load factor. The only advantage to offset the additional rate is the increased efficiency. At least 75 per cent efficiency can be obtained with the continuous storage method. This means that the relative rates per kilowatt-hour for the instantaneous method and the continuous storage method must be in the ratio of 100 to 75 for an equal cost of operation. Such rates cannot be obtained at present. Flat rates as low as $3 per kilowatt-month are being obtained for continuous heaters. This immediately gives the continuous method first place, when considering cost of operation. At the same rate, with

the proper size of tank and heater, the continuous storage method is somewhat cheaper than the intermittent storage method, due to a slightly higher efficiency. The initial cost of a large heater for instantaneous service would make the installation more expensive than would be the intermittent or the continuous storage system. The little difference in the cost between the intermittent and the continuous storage systems is in favor of the continuous system. The final conclusion is that the continuous storage system is by all odds the most practical, considering service, cost of operation and initial cost.—*Gen. Elec. Review*, October, 1916.

Grid Resistors.—H. H. Johnson discusses the desirability and possibility of standardizing grid resistors for tramway service, while Joseph D. Bissell discusses possibilities of reducing the weight of grid resistors. A reduction in grid weight for the same continuous grid capacity can be accomplished by reducing slightly the cross-section of the active resistor element and increasing the spacing of the grids by widening the boss, thus giving better ventilation. The reduction is, of course, accompanied by a reduction in thermal capacity, which amounts to approximately 35 per cent average. A comparison is given between standard narrow-boss grid resistors and light-weight wide-boss grid resistors. —*Elec. Journal*, October, 1916.

Units, Measurements and Instruments

Wehnelt Cathode-Ray Tube Magnetometer.—CHAS. T. KNIPP and L. A. WELO.—The author recently described an apparatus for determining the horizontal intensity H of the earth-magnetic field, depending on the measurement of the magnetic and electrostatic deflections of a beam of cathode rays and on the assumption of the ratio of the charge to the mass of the electron. It has since been suggested to the authors that it might be well to deduce H by comparing the deflection produced by the earth's magnetic field with the deflection produced by a known calculated field, thus avoiding the assumption of the ratio e/m. The apparatus used in carrying out the suggestion is shown in Fig. 2. The discharge-tube is a glass jar which can be turned around a vertical axis and is exhausted through a glass stem inside a brass pipe connected to the center of the bottom of the jar. The cathode is shown at C. The object of using the Wehnelt cathode rather than the cold aluminium cathode is to secure electrons having a low velocity with consequently measurable deflections for the relatively weak earth-field, and at the same time get a definite beam of sufficient range without the use of diaphragms. The direction that the beam takes is uncertain, and two adjustments of the cathode are necessary, one in the plane of the drawing and one perpendicular to it. The anode is an aluminium ring of nearly the internal diameter of the jar, lying at its bottom, and connected by a wire to mercury at the bottom of the glass stem below the joint J_1. The mercury is in contact with a sealed-in platinum wire, which is connected to the positive terminal of a high potential battery. Since the cathode and the wire leading to the anode from the inside of the exhaust-tube are very close together, a mica screen is inserted at M to prevent a direct discharge, which might take place if the vacuum were at a favorable stage, with possible injury to the battery. The deflections of the beam of particles are recorded on a photographic plate held near the top of the tube in a simple form of plate holder and shutter. The platinum strip on which the line is placed is heated electrically. In the illustration S represents the connections of the standard coil to the battery, H of the heating circuit to the battery and DIS of the discharge circuit to the high-potential battery. The coil of six turns, wound so close that the current may be considered a circular one, is wound on a built-up and accurately turned wooden core. It is pivoted on the horizontal support, shown above the discharge-tube, so that it hangs vertically, but is prevented from turning about a vertical axis by an adjustable clamp on the support. A pointer on the coil which moves over a graduated circle on the support gives the orientation. A pointer on the brass supporting-pipe and a graduated circle on the wooden frame give the orientation of the tube itself. When it is desired to remove the cover from the discharge tube, the coil is lifted off and the support swung back about the pivot P. When making a determination, the pump is generally run for over an hour, the charcoal bulb being gently heated during the while to drive off gas absorbed at ordinary temperatures. When the bulb has cooled it is immersed in liquid air. The heating circuit may soon be closed, the resistance adjusted until the platinum glows with a red heat, and 1000 volts now applied between the cathode and anode. It is well to leave the glowing cathode thus for, say, five minutes. If the heating current is then slowly

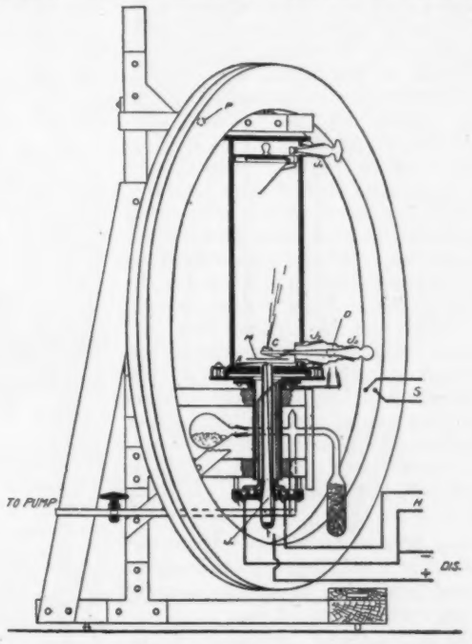


FIG. 2—DEVICE FOR DETERMINING EARTH'S MAGNETIC FIELD

increased a diffused spot will show on the plate holder lid, which is covered with willemite. On further heating the diffused spot becomes either a well-defined spot or a sharp line in a plane containing the platinum strip. After the cathode has been adjusted so that the spot is east of the center of the plate holder by an amount equal to the estimated deflection (and in the plane of the coil), and the orientation of the tube noted, the plate holder is opened and an exposure made for five to fifteen seconds, depending on the intensity of the beam. The switch of the coil circuit is then closed so that the beam is deflected still more, and the exposure at the new spot made. Then the plate holder is closed, the tube turned to 180 deg., the plate holder again opened and the process repeated. Thus four spots or lines are obtained on the plate, which should be arranged along a straight line. Half of the distance between the two inner spots is the deflection due to the earth's field alone, while half the distance between the outer two is the deflection with the earth's field increased by the standard one. The theory of the instrument is given in some detail. The mean result of seven determinations is $H = 0.1583$ in *c.g.s.* units.—*Phil. Mag.*, October, 1916.

W. C. ALLEN

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Walter C. Allen of Washington, D. C., who for the last twelve years has held the position of electrical engineer of the District of Columbia, was on Oct. 19 appointed executive secretary of the District Public Utilities Commission. Mr. Allen succeeds Maj. Julian L. Sley, who was recently assigned to the United States Engineer Office at New Orleans. Mr. Allen has been in the service of the District for the last twenty-two years, starting with the street-lighting division as superintendent of lamps. In 1904 the position of electrica engineer was created and Mr. Allen was appointed to the position in charge of the department. During the years of his administration a large amount of important ornamental street lighting has been installed in Washington under Mr. Allen's supervision. Mr. Allen is a graduate of the University of California.

Edward Wray has resigned from the *Railway Electrical Engineer* to become associated with the Sangamo Electric Company, Springfield, Ill.

James D. Southard, manager of the Albuquerque (N. M.) Gas, Electric Light & Power Company, has been appointed president of the local state fair association.

William L. Abbott, chief operating engineer of the Commonwealth Edison Company, who is also president of the board of trustees of the University of Illinois, was tendered a dinner Nov. 4 at the Hotel La Salle, Chicago, by the alumni of the institution, in recognition of his service on the board, of which he has been a member for twelve years. Mr. Abbott is a graduate of the University of Illinois class of 1884.

Frank Houston, commercial manager of the Lockport Light, Heat & Power Company, Lockport, N. Y., has resigned to become associated with E. Z. Wallover, formerly manager of the local power company, who is now interested in power development in Oklahoma City. Before his departure for the West, the members of the Lockport Board of Commerce, including the leading electrical men in Niagara County, tendered a complimentary luncheon to Mr. Houston.

W. T. Kyle, formerly manager of the New York office of the Duplex Metals Company, and for the past two years connected with The Okonite Company, has resigned to become the manager of the copper-clad steel department in the New York office of the Steel Sales Corporation.

O. R. Tomann has been appointed general superintendent of the Red Oa' Electric Company. Mr. Tomann received his technical education at the Universities of Wisconsin and Indiana. The Red Oak Company owns and operates elec tric lighting and power systems in thirteen towns besides the city of Red Oak, having approximately 120 miles of 33,000-volt transmission lines.

W. R. McGovern has been appointed chief engineer of the central group of Bell Telephone companies, succeeding James G. Wray, who resigned to be associated with the engineering firm of Hagenah & Erickson. Mr. McGovern, who was formerly state engineer for the Chicago Telephone Company, is succeeded in that position by J. S. Ford, formerly building engineer in the state engineering department.

Ford W. Harris of Los Angeles, Cal., for many years connected with the Westinghouse Electric & Manufacturing Company, and formerly engineer in charge of design of circuit-breakers, switches, and fuses, has been admitted to practice law in the courts of California. Mr. Harris is also a Fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers. He plans to specialize in patent law and trade-mark causes.

W. R. Putnam of Salt Lake City has been appointed manager of the Salt Lake division of the Utah Power & Light Company, combining this position with his duties as general sales manager of the company. Mr. Putnam is well known as the chairman of the N. E. L. A. committee on electric ranges, the work of which during the past eighteen months has attracted widespread attention among central station men interested in the introduction of electric cooking. Mr. Putnam has himself devoted particular attention to the local development of the domestic electric cooking load, some 600 electric ranges being already in service on the Utah company's lines. Mr. Putnam is a graduate of the University of Minnesota. For a number of years he was manager of the electric lighting company at Red Wing, Minn., and Rapid City, S. D., and later acted as general superintendent of the Wisconsin-Minnesota Light & Power Company, at Menomonie, Wis., and Marinette, Minn.

R. W. ROLLINS

Robert W. Rollins, who was elected president of the New England section of the National Electric Light Association at the convention in Pittsfield, Oct. 17-20, is one of the best known central-station managers in the East. He was born at Newbury, Vt., in 1864, received his education at the local schools and seminary, and in 1885 was employed by the Hartford (Conn.) Electric Light Company in station and distribution service. Later Mr. Rollins joined the Schuyler Electric Company of Hartford, manufacturers of dynamos, and afterward he returned to the Hartford company as station operating engineer; soon, however, being placed on the road by the Waterhouse Electric Manufacturing Company of Hartford, installing arc lighting plants. In this connection he installed the first arc-lamp equipment placed in Havana, Cuba, the equipment being driven by vertical engines. For about a year Mr. Rollins served as district engineer of the Boston office, Westinghouse Electric & Manufacturing Company, following the absorption of the Waterhouse company by the former. In 1890 he was again recalled to Hartford as assistant superintendent of the lighting company, soon becoming general superintendent and then general manager. For many years Mr. Rollins was closely associated with Austin C. Dunham, who was president of the Hartford company for nearly a third of a century. In 1911 Mr. Rollins became general manager of the Worcester (Mass.) Electric Light Company; was soon elected president and combined the duties of both offices under the joint title. In the five years of his administration the annual output has increased from 9,000,000 to 40,000,000 kw.-hr., and the company has become one of the best modern examples of a progressive public utility enjoying the confidence of the consumer and the Worcester public alike.

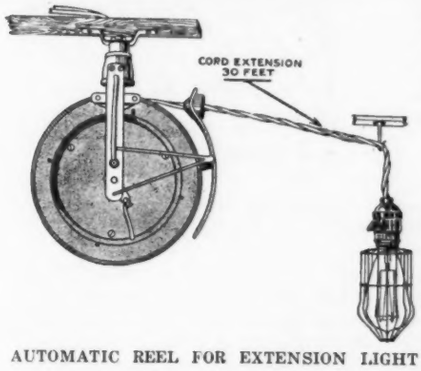
L. H. Haight, for the last ten years with the New York sales office of the Westinghouse Electric & Manufacturing Company, has been appointed New York City sales representative of the Ward Leonard Electric Company, Mount Vernon, N. Y.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Automatic Extension Reel

An extension light which possesses convenient and serviceable features is shown in the accompanying illustration. The reel carries 30 ft. of lamp cord, and is secured to ceiling or beam by fastening the arms of the swivel joint as shown. It has been developed by the



AUTOMATIC REEL FOR EXTENSION LIGHT

Automatic Extension Reel Co. of Liberty, Ind. The swivel joint enables the user to walk in any direction with the lamp, and an automatic lock provided holds the reel after the lamp cord has been paid out so that the lamp may be used at a distance from the reel. A slight pull forward unlocks the ratchet, and the wheel revolves, winding the cord back. An adjustable stop-plug on the cord makes it possible to adjust the height of the lamp.

Reflectors for Industrial Lighting

A line of 6.5-in. parabolic reflectors and holders that produce concentration of light downward is now offered to the

REFLECTOR MADE IN ALUMINUM, STEEL AND BRASS DESIGNS

trade by Harvey Hubbell, Inc., Bridgeport, Conn. This result, it is claimed, is best obtained by locating the reflectors at an angle of 30 deg. off the horizontal, when the reflectors are attached to sockets suspended in a vertical position. These reflectors are made in aluminum, steel or brass. The aluminum and steel designs are finished in a shade of green outside and a matt aluminum of superior reflecting qualities inside. Brush brass is the standard outside finish for the brass shades with aluminum inside, but any other finish can be supplied. The reflectors are equipped with standard Hubbell contractile collar, which permits the rigid attachment of the reflector to the socket without the use of an additional shade holder.

Special Electric Range for Export Trade

The electric range shown in the accompanying illustration, which has been designated as model 125 by its maker, the Rutenber Electric Company, Marion, Ind., was designed especially

ELECTRIC RANGE WHICH MAY BE KNOCKED DOWN FOR CRATING PURPOSES

for foreign trade. This design was selected because eight of these ranges, when knocked down, can be packed in a crate of the size ordinarily needed to inclose one range of the company's other models. By effecting this saving in packing space the Rutenber Company saves its foreign agents a considerable amount in shipping expenses. This model has three top burners, each rated at 1000 watts. It stands 34 in. high and the dimensions of its top are 20 in. by 26 in. Its shipping weight is 55 lb. Another model, known as No 120, of similar design, is also being built. It differs from model 125 in that it has two burners instead of three and weighs 5 lb. less.

Weatherproof Sockets

A line of pull, key and keyless sockets for resisting damage by exposure and chemical action has been placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn. These weatherproof sockets have an aluminum cap, the bushing of which is tapped with a 0.5-in. thread inside and a 0.75-in. thread outside. They are designed primarily for use as a part of outdoor fixtures. The fixture canopy may be dropped over the socket cap, leaving the threaded bushing protruding through, and to this bushing a lock nut may be threaded to hold the canopy rigidly in place. The unit can then be screwed to either a hollow gooseneck or bracket through which the wires pass. This, the maker states, is only one of a large number of uses to which this line may be adapted.

OUTDOOR SOCKET

A Disappearing Footlight

Disappearing footlights for stages and platforms of high schools, auditoriums, halls, churches and theaters, also showrooms, show windows or wherever a footlight is required that must be out of the way when not in use, have been designed and are being manufactured by the Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York City. These footlights are made up and furnished in complete sections 3 ft. to 5 ft. in length, which can be mitered to fit any stage curvature, or in longer straight sections. They can also be provided for a single or double row of lamps with two or more color combinations.

Each section as furnished consists of a top frame and door made of 1-in. hardwood to match the flooring, so that all that is required for installing a sec-

FIG. 1—SECTION OF DISAPPEARING FOOTLIGHT OPEN

tion is to provide a space in the floor of sufficient depth and width to receive the unit. The top of the footlights is inserted flush and floored in to form a part of the stage floor. The footlights are mounted on the lower side of the

door, and, agreeable to the Underwriters' rules, they are set in a galvanized-iron reflector trough. Connections are made through an iron splicing box, which can be placed either in the center of the section or at the end, as is necessary for clearance between studs or beams. The door or cover of the footlights is hinged on a special heavy iron bracket hinge supported on the top frame, and each cover is provided with a flush ring and lock at the center, as shown in the illustration. To raise the footlights the doors are opened by means of the pull strings.

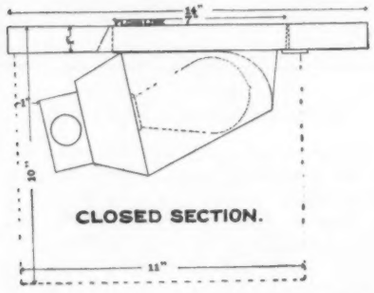
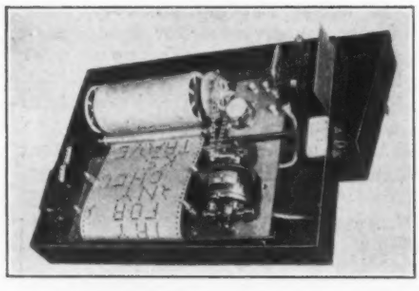


FIG. 2—CLOSED SECTION VIEW OF DISAPPEARING FOOTLIGHT

Electric Sign Bulletin

"Electrograph," an electric-sign bulletin that displays a complete message and is made for use inside of building halls or in the open air, was described in the Aug. 16, 1916, issue of the ELECTRICAL WORLD. The Electrograph Company, 53 Jackson Boulevard, Chicago, maker of this apparatus, announces the development of a new controller for this outfit. This controller case, which is illustrated here, is made for signs that require from 500 up to 2500 watts. The record passes slots in the bottom of this case, provision being made to roll it up in a chute or box so that the length of message is not limited. The illustration shows the record with the brush block removed. This block is held in place by the four bolts, two on each side of the record.

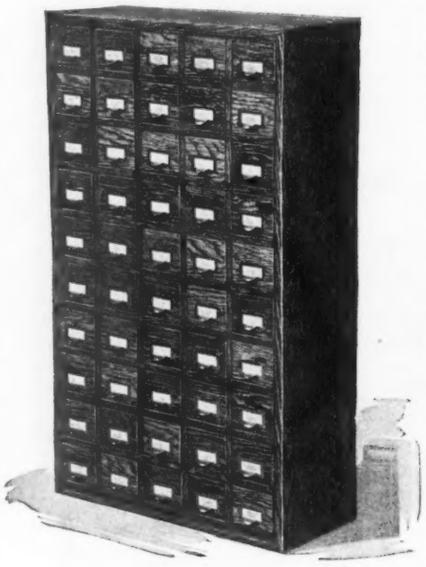


CONTROLLER FOR TALKING LAMP SYSTEM THAT WILL REPRODUCE COMPLICATED SYMBOLS

Attention is called by the manufacturer to the adaptability of this system, stating that the fifteen-lamp row will permit the reproduction of the most complicated symbols, such as Chinese or Japanese characters. As there are 214 letters in these foreign alphabets, the 40,000 combinations possible are given as an indication of the extent to which the system can be utilized.

A Shop Screw Cabinet

In the accompanying illustration is shown a screw cabinet, which affords a convenient means for handling screws and small parts due to mixed sizes and broken packages in plant and factory workshops. This cabinet may be used for brads, nails, butts, bolts, auto accessories and many other small articles. These cabinets are made in sizes containing 50 or 100 drawers. The drawers are 8 in. by 3 in. by 2½ in. with drawer pulls and cord holders. The cabinet is golden oak with a dull waxed finish. The outside measurement of a 100-drawer cabinet is 44 in. wide by 32 in. high by 11 in. deep, the 50-drawer cabinet being 22 in. wide. Hobart Bros. Company, Troy, Ohio, are the manufacturers.



A 50-DRAWER SCREW CABINET

Special Distribution Circuit

In the accompanying illustrations special arrangements are shown so that the busbar principle can be applied to interior distribution systems where it is desired to frequently change or transfer lights, electric letters, fans, heating and light power devices. The casing shown in Fig. 1 is of steel, in two parallel pieces with openings equidistant, corresponding with connection points in the conductor element or buses inclosed in this casing. The conductor element consists of Bakelite molded insulation with two phosphor bronze conductors embedded therein. These conductors have a cross-sectional area equivalent to 56,000 circ. mils, rated at about 75 amp. on a 110-volt circuit. Two No. 12 B. & S. gage stranded rubber-covered wires are considered ample as feeders for this bus arrangement. In Fig. 2 is shown a side view of a show-window installation, with its positive lever contact plug for connecting light and reflector or other devices to the buses. This system has been developed by the Chase Electric Company, 105 South Dearborn Street, Chicago, Ill.

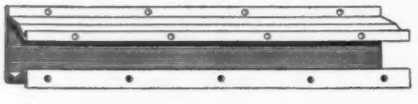


FIG. 1—STEEL CASING FOR CONDUCTOR ELEMENT

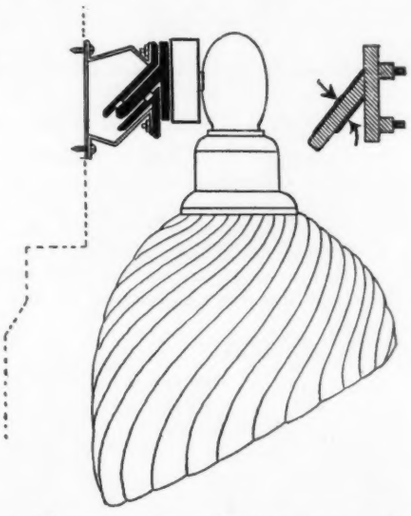
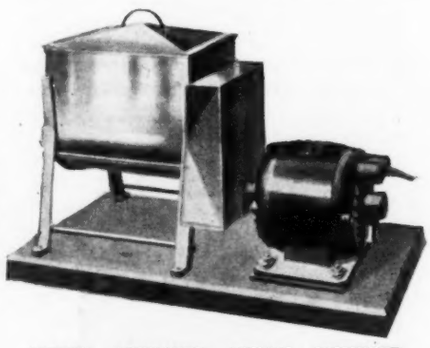


FIG. 2—SIDE VIEW, SHOWING CONNECTION FOR SHOW WINDOW REFLECTOR

Electrically Operated Cream Whipper

The outfit illustrated is manufactured by the White-Stokes Company of Chicago, and is suitable for whipping cream and similar materials. The set consists of a 1-gal. hopper which is equipped with a rotating beater or dasher driven through gears by a ⅛-hp. Robbins & Myers motor. The gears and bearings of the whipper are made of bronze and no oiling is necessary, it is claimed. By removing a pin from the axle, the dasher can be lifted out for cleaning, and easy access is given to the interior of the hopper. The motor is supplied with 10 ft. of cord and plug for connecting to any lamp socket. The base of the outfit is 14 in. by 22 in.



MOTOR OPERATED CREAM WHIPPER WHICH IS SUITABLE FOR WINDOW DISPLAY

Return Line Heating Pump

An interesting development in vacuum pumps for return line work has been made by the Nash Engineering Company of South Norwalk, Conn. A turbine pump is direct-connected to an electric motor and is furnished in five sizes, suitable for handling from 8000 to 65,000 sq. ft. of direct radiation or its equivalent, with special units designed to take care of very large heating systems. The pump is described by the maker as two pumps in one, a hydro-turbine air pump, and a centrifugal water pump, both contained in one casing, the impellers of each pump being on the same shaft, which is supported on highest grade annular ball bearings, mounted outside of the casing. Unlike many return line pumps, it is pointed out, the air and water are separated before reaching the pump. This arrangement, it is claimed, makes it possible to relieve back pressure, as the water only is delivered against the boiler pressure. The water is handled in a pump designed for water, and the air in a pump designed for air, which makes a much higher efficiency possible than where the water and air are handled both together.

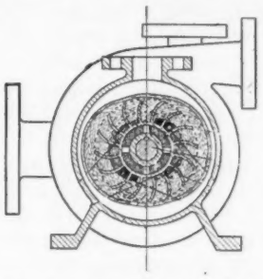


FIG. 1—AIR END OF PUMP

For the reasons stated, and as a result of careful design, these pumps require motors of from 1 hp. to 5 hp. The water end is so designed that the outfit is unloaded when not handling water. In other words, the power required for operation is proportional to the condensation returned.

The air end of the pump works on a very simple and ingenious principle,

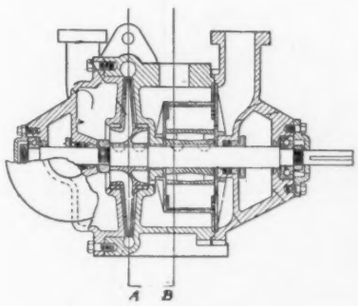


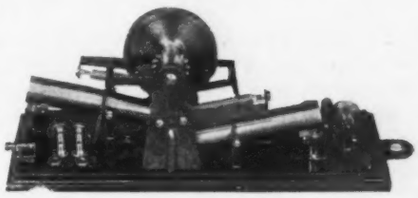
FIG. 2—AIR AND WATER PUMP IN ONE CASING

being a development of the Nash hydro-turbine air compressor and vacuum pump, which has been made by the Nash Engineering Company for about seven years. The impeller revolves freely in an elliptical casing, carrying water around with it. The water follows the casing due to centrifugal force, and alternately recedes from and surges back into the impeller, twice in a revolution. As the water leaves the impeller it draws air in through ports cut in the side of the casing. As soon as the blades of the impeller (now filled with air) pass the inlet ports, the air is trapped. The re-entering water compresses the air and delivers it through outlet ports. As the peripheral clearance between the casing and the impeller is never less than 1/32 in., and the shaft is supported on large ball bearings, the pump maintains its original high efficiency. All valves, gears, loose blades or reciprocating parts have been eliminated, it is pointed out, and as there are no bearing adjustments to make, the pump requires practically no attention in service other than two or three times during a season to supply the ball bearings with lubricant.

Long Distance Water Stage Recorder

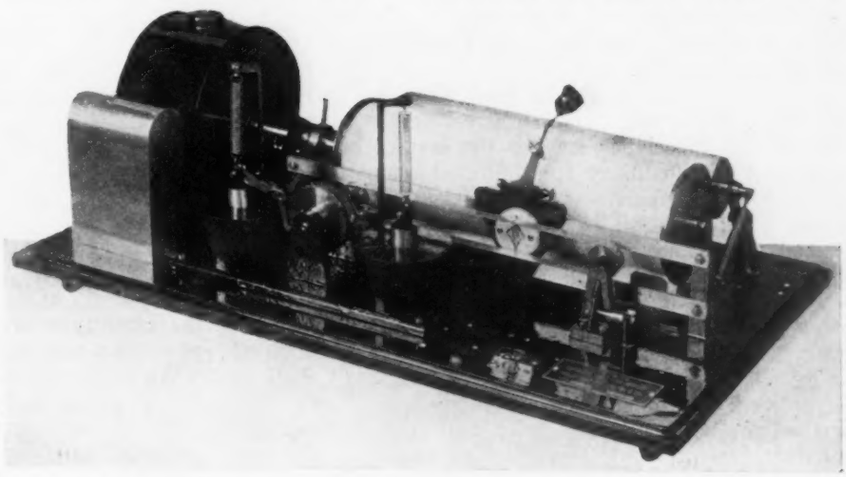
In the accompanying illustration a long distance water stage recorder is shown which is designed to produce in a power house, pumping station or office the fluctuations of levels from any distant body of water, oil or other liquid. It operates on open circuit arrangement using ordinary dry cells and two wires. However, one wire and a ground return have been used in many places with perfect success, it is claimed. The sender which is placed over the water embodies a float pulley with spines on its circumference. Over this runs a perforated bronze band that connects at one end with a float resting upon the water surface, and at the other end with a counterpoise. Attached to the same shaft with the pulley are two small ratchet wheels with teeth opposed to each other. Whenever the float turns the pulley a given amount in one direction, a contact is made which completes the electrical circuit between the sender and the receiver. The circuits are closed by a device whereby a contact of nearly a second's duration is secured, since a contact of some duration is essential to the operation of the receiver. Except during the one second in which the water stage completes its change interval, there are no completed electrical circuits.

The receiver is fixed to the base plate of the recorders. It consists of a shaft, upon which is mounted the small spine wheel that drives the pencil carriage of the recorder. Two ratchet wheels are also mounted upon the same shaft with their teeth in opposite directions. Playing upon the teeth of each ratchet wheel is a pawl mounted upon an arm swinging from the main shaft. The other end of this arm carries a plunger that moves in a solenoid. Whenever a contact is made by the sender, the current passing through the solenoid draws the plunger within it and moves an arm which causes the pawl to turn the ratchet wheel the space of one tooth. This turns the spine wheel which moves the pencil a corresponding amount. The two ratchet wheels on the receiver follow those on the sender, both in direction and amount. Both the sender and the receiver are provided with suitable locking devices that prevent a contact being made except at the proper time, thus avoiding the danger of short-circuiting the batteries, or producing any movement of the pencil except that originating at the distant water surface.



SENDING APPARATUS FOR WATER STAGE RECORDER

The solenoids of the receiver are operated by four dry cells connected through a specially designed polarized relay mounted on the base of the recorder. The sender operates the relay through the line wires, the current being always in one direction for a rising stage and in the opposite direction for a falling stage. This long distance water stage recorder is made by Leupold, Voelpel & Company, of Portland, Ore.



RECEIVING APPARATUS FOR LONG DISTANCE WATER STAGE RECORDER

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

SAVINGS PLAN FOR NEW ENGLAND POWER EMPLOYEES

Company Offers Opportunity to Subscribe Prior to New Year for Limited Number of Shares of Preferred Stock

Further prominent light and power utility has entered the list of those who promote savings on the part of employees by offering to sell to them shares of the company's stock on an installment plan prorated according to the employee's salary. In offering this plan to its employees this company, the New England Power Company, makes the following statement:

"The employees who subscribe to it [the plan] will secure a convenient form for making systematic savings and at the same time a greater return than is possible through any of the usual savings plans.

"It is expected that the company will benefit through having employees who are also stockholders and the happy relationship already existing be made even closer and more permanent.

"While it is believed that this is an opportunity which no one who is eligible should neglect to take advantage of to some extent at least, it should be distinctly understood that failure to subscribe will not in any way affect the employee's standing with the company."

Some of the terms under which the employees may subscribe are given below. Not more than 500 shares are at the disposal of the managers of the plan.

The subscription price shall be $100 per share, and subscriptions shall be for one or more shares of New England Power Company preferred stock as allotted by the trustees of the New England Company, at their discretion, but the number of shares subscribed for by any subscriber shall not in any event be such that the monthly installment hereinafter provided for would exceed 20 per cent of the subscriber's monthly salary.

Payments of subscriptions may, at the election of the subscriber, be made either in whole at the time of the acceptance of the subscription or in monthly installments at the rate of $2 per share, said installments to be deducted from the wages or salary of the subscriber and the subscriber may from time to time make additional payments on account of the unpaid balance or pay off the same in full.

Subscriptions, unless fully paid, shall be cancelled in full but not in part, (a) on request of the subscriber; (b) on the subscriber leaving the service of the company and its subsidiary and affiliated companies, either voluntarily or otherwise; (c) on death of subscriber. When a subscription is so cancelled, there will be returned to the subscriber the full amount of payments made, with interest.

In addition to the dividends paid if earned on the stock, an extra payment will be made on Dec. 15 of each year beginning Dec. 15, 1917, conditions and amounts being as follows: (a) The "extra payment" shall be payable only to the officer or employee himself who subscribed for the stock hereunder and upon his sole and separate receipt. (b) The officer or employee who subscribed for the stock hereunder shall have continued in the service of the company or of some of its subsidiary or affiliated companies continuously from the date of the subscription to the date the extra dividend is payable, and shall in the opinion of the trustees have shown a proper interest in the company's welfare and progress. (c) The subscription shall not have been cancelled and the officer or employee who subscribed for the stock hereunder shall not have lost or parted with any of his rights thereunder or with any of the stock subscribed for or any of his rights therein or thereto or hypothecated the same and shall on request present for inspection original certificate to the treasurer of this company or some other officer designated by the treasurer, if the subscription has been fully paid and the stock delivered. (d) The rate of the "extra payment" shall be as follows: 1917—1 per cent; 1918—1.5 per cent; 1919—2 per cent; 1920—2.5 per cent; 1921—3 per cent; 1922—3.5 per cent; each year thereafter—4 per cent.

Should the officer or employee who subscribed for the stock hereunder, die, or, in the opinion of the trustees, be so disabled as to be unfitted to remain in the employ of the company, at any time after the acceptance of his subscription by the trustees, the company will, in addition to all other rights arising out of his subscription as hereinbefore provided, pay to him or to his heirs, a sum equal to the par value of the shares subscribed for, but not exceeding $1,000, provided he was, at the time of such death or disablement, in its service or in that of one of its subsidiary or affiliated companies, and otherwise within the conditions entitling him to "extra payments."

A Thermo-Electric Wattmeter

Thomas W. Varley of New York, in patent No. 1,199,444, discloses an ingenious arrangement whereby thermo-electric couples such as may be made out of bismuth and antimony are carried to operate a wattmeter, though

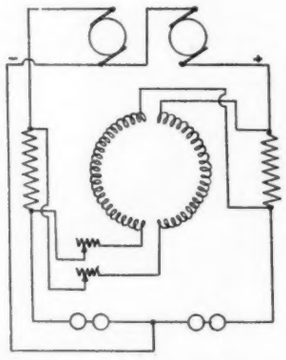


DIAGRAM OF CONNECTIONS

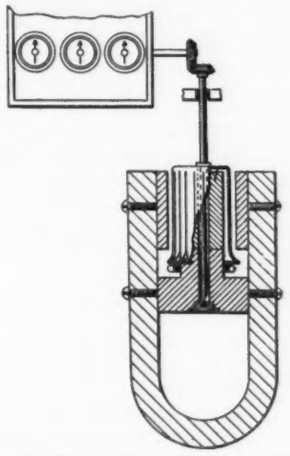
the same type of mechanism can equally as well be applied to a watt-hour-meter.

An armature in the form of an inverted cup is supported on a shaft located in the air gap between the poles of the magnet and the core. The armature comprises a cup of copper, slotted to form conducting strips. and attached to a ring of a suitable metal or alloy. The metals of the cup and ring are preferably selected so

as to have differences of electromotive force set up in them by the application of heat at the points of junction of the two metals, each such junction thereby constituting a thermo-electric couple.

Connected across the source of electricity supply is a heating coil circuit which leads to one side of the armature. The thermo-couples on this side will therefore be heated in a manner corresponding to the voltage of the source. On the other hand, a second heating coil is arranged on the opposite side of the armature whose temperature rise will in general depend upon the voltage drop across a shunt or series of shunts placed in series with the line. In this way the difference of temperature rise on the two sides of the armature sets up currents in the strips of the armature cup, which becomes a measure of the watts expended in the power circuit.

As the thermo-electromotive force is a function of the heat, the two sets of junctions will have a resultant



INTERIOR CONSTRUCTION, SHOWING ARMATURE

electromotive force, sending current up one side of the cup and down the other. These currents produce a torque of rotation on the cup. As the cup rotates a counter-electromotive force is set up in the two sides of the cup tending to stop its rotation, the final speed of the cup being such that the thermo-electromotive forces less the counter-electromotive forces give net electromotive forces sufficient to cause currents to flow to overcome the friction of rotation.

Since the net difference in temperature is a function of the product of the line voltage times the amperes of the load the effort of turning varies with the watts of the load.

Public Service Commission News

District of Columbia Commission

The Public Utilities Commission has drawn up a set of proposed regulations concerning the approval of watt-hour meters for use in the District of Columbia. These regulations closely follow those recently promulgated by the Bureau of Standards, the commission states. For the purpose of considering the adoption of these regulations, the commission will hold a formal public hearing on Dec. 6.

Illinois Commission

The State Public Utilities Commission has authorized new gas and electric rates for the city of Peoria. These rates carry a reduction of approximately 10 per cent and create an annual saving to consumers of $100,000. The gas schedule is of block form, with the initial rate at 85 cents per thousand cubic feet. The electric schedules are principally of maximum demand form with initial rates of 9 cents for residential consumers and 9 cents for commercial consumers. No changes are made in the power schedules or in the special-service schedules.

The new residential schedule is a new departure in the State of Illinois, in that the maximum demand is computed on the so-called "room basis." In permitting this "room basis" to be used, the commission gives as its reason that the said basis has been agreed upon by the utility and the Common Council of the city of Peoria.

New Jersey Commission

The Board of Public Utility Commissioners has denied the petition of the Lakewood & Coast Electric Company to restrain the Atlantic Coast Electric Light Company, operating in neighboring territory, from making proposed extensions. The Lakewood company held that the Atlantic company is making a practice of erecting pole lines and wires in competitive districts to an extent entirely unwarranted by the company's business. In its decision the board says that the general policy of making extensions in new territory and the development of business therein is primarily a question for boards of directors to determine.

Colorado Commission

At a general session of the Public Utilities Commission held recently, it was ordered to take effect Nov. 1, 1916, that in case of change of ownership or control of a utility, or when a utility, or portion of utility, is transferred from the operating control of one company to that of another, or when its name is changed, the company which will thereafter operate the utility, if it intends to use the tariff publications and rates of the former operating company, shall unite with the former company in the publication and filing of common supplements to the schedules on file with the commission, on the one hand withdrawing, and on the other hand accepting and establishing such tariffs. Such common supplements shall be executed jointly by the tariff issuing officers of both the old and the new companies, shall be numbered consecutively as supplements to the schedules to which they are directed, and may be made effective on immediate notice to the public and to the commission, by noting thereon reference to this order of the commission.

New schedules reissuing or superseding the then effective schedules shall be numbered in the Colorado Public Utilities Commission series of the newly formed company.

The company surrendering control of the property has no lawful right to abandon its schedules except on lawful notice, *i.e.*, thirty days, and when it surrenders control of the property it surrenders all right to publish rates applicable thereto except under proper authority from the company to whose control the property passes.

The public has a right to the existing available and lawfully applicable rates of that property.

The adoption notice shown on the common supplements issued under this order shall read substantially as follows:

"The (name of new company) hereby adopts, ratifies and makes its own in every respect as if the same had been originally filed and posted by it, all schedules, contracts or other instruments whatsoever, filed with the Public Utilities Commission of the State of Colorado by the (name of old company) prior to (date) the beginning of its possession."

Similar adoption notice must be filed by a receiver when assuming possession and control of a public utility property.

Insulator Design to Be Discussed by Toronto Engineers.—A paper entitled "Insulator Design" will be presented on Nov. 24 before the Toronto section, A. I. E. E. by A. O. Austin, chief engineer, Ohio Brass Company.

Los Angeles Jovian League.—Mrs. Estelle Lawton Lindsay, a member of the Los Angeles City Council, addressed the local league on Oct. 25. Her subject was "The New Friendship Between Men and Women."

San Francisco Section, A. I. E. E.—The regular monthly meeting was held on Oct. 27. W. J. Davis, Jr., Pacific Coast engineer General Electric Company, presented a paper on the operation of Curtis turbines and reduction gears for special propulsions. The talk was illustrated with stereopticon views.

Ladies' Night at Western Society of Engineers.—On Oct. 31, which was ladies' night at the Western Society of Engineers, Chicago, D. W. Roper, of the Commonwealth Edison Company, related his experiences while visiting cliff dwellings and climbing mountains in Colorado. After his talk, which was illustrated with lantern slides and motion pictures, light refreshments were served.

The Radio Club of America.—The October meeting of the club was held on Oct. 20 at Columbia University, New York City. Edwin H. Armstrong lectured on "The Relation of the Heterodyne Theory of Amplification to the Oscillating Audion." This lecture was a continuation and extended discussion of the matter treated of in the paper recently presented by Mr. Armstrong before the Institute of Radio Engineers.

Insulating Oils Discussed at Pittsfield.—The second annual meeting of the season for the Pittsfield section of the American Institute of Electrical Engineers was held on Oct. 26. This was the first lecture in the course of seven on materials used in manufacture of electrical apparatus. The subject was "Insulating Oils" and the speaker was W. H. Miller, superintendent of the Tide Water Oil Company, Bayonne, N. J.

Empire State Gas & Electric Association Officers.—The new officers of the Empire State Gas & Electric Association are as follows: President, Stuart Wilder; first vice-president, H. M. Beugler; second vice-president, H. W. Peck; treasurer, C. A. Graves; secretary, C. H. B. Chapin; as members of the executive committee: to serve three years, J. C. DeLong, A. B. Tenney, C. G. M. Thomas, M. J. Brayton; to serve two years, E. H. Rosenquest, F. H. Hill; to serve one year, S. J. Magee.

Texas Contractors Convene.—The Texas Electrical Contractors Association held its annual convention in Dallas a few days ago. It was presided over by President W. H. Earl of Dallas. The discussion covered a number of matters relating to the welfare of the members of the organization. About thirty electrical contractors were in attendance. The social features of the meeting were very enjoyable and embraced among other things a banquet at the Adolphus Hotel, at which Mayor Lindsley was present and made an address.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Boston Institute Meeting in December.—The 327th meeting of the American Institute of Electrical Engineers will be held in Boston, Mass., on Dec. 8. There will be an afternoon and an evening session. The afternoon session will be devoted to papers and discussions on the general subject of "The Standardization of Circuit Breakers with Regard to Their Rupturing Capacity." The principal feature of the evening session will be the presentation of the John Fritz medal, which has been awarded to Dr. Elihu Thomson. As members of various engineering societies will be present, it is planned to conclude the evening session with a lecture on some subject which will be of great interest.

New York Meter Men Meet.—A meeting of the electric meter committee of the Empire State Gas & Electric Association was held on Nov. 9 in the rooms of the Rochester Engineering Society. The general subject for discussion was "The General Operation of an Electric Meter Department." An opportunity was afforded those attending of visiting the meter department of the Rochester Railway & Light Company. On Friday a joint meeting of this committee and that on electric distribution was held in Rochester to consider the subject of grounding of secondaries on alternating-current distribution systems. Representatives of the Board of Fire Underwriters were invited to attend this meeting.

Tentative Program for Kansas Utility Convention.—The tentative program for the convention of the Kansas Public Service Association, National Hotel, Topeka, Kan., on Dec. 7 and 8 is as follows: "Transmission Lines Solve the Small Town Electric Lighting Problems," by C. A. Leland, Jr., Atchison, Kan.; "The Joint Use of Electric Light and Telephone Poles," by J. P. Kobrock, St. Joseph, Mo.; "The Protection of Transformers and Distribution Systems from Lightning, and Grounding Secondaries," by J. E. Gossett, Topeka, Kan.; "Water Treating and Boiler Washing and Their Relation to Fuel Economy," by C. T. Reese, Topeka, Kan., and other papers by J. E. Harsh, Salina, Kan.; W. W. Austin, Cottonwood Falls, Kan.; W. A. Scothorn, Junction City, Kan.; A. MacLachlan, Detroit, Mich. The convention this year will be limited to two days instead of three days, as has been the previous practice.

Competition to Obtain Distinctive Name for Company Section Bulletin.—Chairman Walter Neumuller of the New York companies' section, N. E. L. A., has just announced a prize competition, which is open to members of the section. The purpose of the contest is to obtain a new name for the official organ of the section which is now known simply as the Bulletin. Mr. Neumuller feels that the magazine possesses but slight individuality under its present name, which does not raise it above the class of a thousand other magazines in every line of business and industry bearing the same name. There are, however, in the electrical industry a number of publications which have really distinctive titles, such as the Edison Round Table of the Chicago company, the Detroit Syncroscope of the Detroit company, and Edison Light of the Boston section. The prize offered for the new name is $10, and the contest will close on Dec. 4. Elaborate preparations are being made for the meeting of the section on Nov. 14 at the Auditorium, Irving Place and Fifteenth Street. Sheriff Alfred E. Smith of New York County will tell many interesting personal reminiscences of politics on the east side of New York. Preceding the meeting a get-together dinner will be held at Scheffel Hall.

Chicago Credit Men to Meet.—The twenty-first annual meeting of the Electrical Credit Association of Chicago will be held at the Hotel LaSalle, next Thursday, Nov. 16. In addition to the regular routine of business, discussion on a number of topics has been arranged for as follows: "Contractors as Credit Risks," by W. G. Clarke, A. T. Knowlson Company, Detroit, and H. C. Downing, Downing Electrical Company, Des Moines; "Turning Him Down, Making Him Pay and Keeping Him a Customer," by T. K. Quinn, National Lamp Works, Cleveland, and Fred H. Alden, Illinois Wire & Cable Company, Sycamore; "Respect for Terms," by L. L. Hill, Page & Hill Company, Minneapolis, and E. L. Sanders, Electric Service Supplies Company, Chicago; "Getting Ahead," by Harry L. Grant, Western Electric Company, Chicago; "Trade Names Accounts," by W. L. Burgess, Burgess-Granden Company, Omaha; "Analyzing a Statement," by I. E. Stiles, Western Electric Company, Omaha; W. A. Brady, Commercial Electrical Supply Company, St. Louis, and Jonathan B. Cook, C.P.A., Chicago; "Customers' Printed Terms on Purchase Orders," by W. P. Crockett, W. P. Crockett Company, Chicago; "Trade Acceptances," by W. H. Bramman, American Carbon & Batt. Company, E. St. Louis; "Value of the Association," by Miss C. L. Aber, Ivanhoe-Regent Works, Cleveland, and V. S. McNutt, Cracraft, Leich Electric Company, Genoa, Ill.; "Suggestions for Service Improvements," by S. R. Driffield, The Consumers Rubber Company, Cleveland; "Municipal Credits," unassigned, open for general discussion. The annual dinner of the association will be held in the evening, when several speakers will deliver addresses on popular subjects.

"Shop Early" to Be Emphasized by Electricity.—According to plans made in Salina, Kan., the person who usually puts off Christmas shopping until the last moment will be constantly reminded to "shop early" by the use of an electric sign bearing these words. The energy and lamps for the sign will be furnished by the Salina (Kan.) Light, Power & Gas Company, for which a vote of thanks by the Chamber of Commerce was tendered the company, and also for its efforts in this campaign.

Crowds Celebrate Installation of Additional Street Lighting.—At the turning on of the lights of 103 additional standards in North Minneapolis recently more than 50,000 people participated in the celebration marking the event. The standards are of the same type as those already installed and for which the different improvement associations pay at the rate of $45 per year per post. Where the different business houses prefer to pay on a per-foot-frontage basis the cost is prorated among them.

Old and New Doherty Cadets at Banquet.—Nearly a half-hundred Doherty cadets, graduates and undergraduates, participated in a "get-together" banquet on Oct. 31 at Fraunces' Tavern, New York City. The purpose was to acquaint the large number of young cadets in the New York office with the executives, almost all of whom are graduates of the Denver school. The series of addresses not only told of the past in the Doherty organization, but forecast the future in glowing terms. Such a one was the opening address of Frank W. Frueauff, of the firm of Henry L. Doherty & Company, who acted as toastmaster. Holton H. Scott, general manager of the operating department, announced his claim to be the dean of the Doherty college men now in the organization, and rehearsed the connection of Henry L. Doherty with the Madison Gas & Electric Company.

Danbury Central Station Makes Reciprocal Contract with Large Isolated Plant.—For mutual accommodation the Danbury (Conn.) & Bethel Gas & Electric Light Company and the F. H. Lee Company have agreed upon a reciprocal contract for the interchange of surplus energy for light and power. This will insure the Danbury company an added yearly load of 36,000 kw.-hr. The Lee company, a large hat manufacturer, operates one of the finest isolated plants in the country. Its electrical capacity is largely in excess of its power requirements, and Charles H. Merritt, general manager of the central station company, believes this alliance has solved the problem of taking care of the increased power demand. The agreement calls for a yearly consumption by the Doherty company of not less than 36,000 kw.-hr., and in case the Lee company needs any power in addition to its plant's capacity the Danbury company agrees to help it out. The installation of the necessary wiring and transformers will be started at once, and the expense will be borne by the Danbury company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Variety of Flashlamps for Londoners.—A dispatch from London states that electric "eyes" in studs and buttonholes have been added to the endless variety of pocket flashlamps as aids to London people in their movements after dark. Women in the West End have been noticed of late using tiny electric bulbs, which are connected by a cord to a battery carried in the pocket or muff. They flash from the eyes of an animal's head on furs worn around the neck or in the hat. Electric brooches for women, it is stated, may also soon appear.

Proposed to Start Immediately on Memphis Municipal Project.—Immediate construction of the proposed municipal light and power plant of the city of Memphis, Tenn., on the bank of the Mississippi River, is proposed by the city commission and its engineer, F. W. Ballard of Cleveland. The Merchants Power Company and the Memphis Consolidated Gas & Electric Company, the two utilities operating in the city, have rejected what was described as the city's final proposal for agreement, and the city will sell the million and a half of bonds on Nov. 14 and go ask the legislature to authorize issuance by the city of another million and a half of bonds. The estimate of Mr. Ballard places the cost of construction of the new plant and the distribution systems, etc., at $2,980,150.

Electric Starting and Lighting for Heavy Gasoline Auto Trucks.—A development which has been long in coming but which may be said to be with us today, according to *The Commercial Vehicle*, is the provision of automatic starting means for the truck and of electric lights. This comes as an expected development, the journal says, if not one somewhat overdue. Formerly electric lighting and starting was principally confined to the lighter vehicles, but for 1917, out of thirty-eight manufacturers fitting electric lighting or starting and lighting systems as stock equipment, more than half are of medium to heavy capacity. Two factors, it is pointed out, have retarded this development more than anything else—technical difficulties and cost. Owners were willing, nay anxious, to use electric light, and while they had no special desire for it, they certainly had no objection to electric starting, but they balked at the cost when legal lighting requirements could be met with kerosene and acetylene lights and mechanical starting meant in many cases nothing more than convenience to the driver. They also demanded reliability and simplicity.

Commercial Electric.—There are nine manufacturers of electric commercial vehicles. For 1917 these manufacturers are putting out trucks in the following capacities, according to the annual compilation of *The Commercial Vehicle*: To have ⅜-ton trucks; five have 0.5-ton trucks; seven have 1-ton trucks; one has 1.5-ton trucks; six have 2-ton trucks; one has 2.5-ton trucks; one has 3-ton trucks; six have 3.5-ton trucks; two have 4-ton trucks; seven have 5-ton trucks, and two have 7-ton trucks and over.

Georgia Railway & Power Wins on Taxation Appeal.—The Georgia Supreme Court has reversed a decision by Judge John Pendleton which denied the Georgia Railway & Power Company an injunction to prevent the comptroller-general from levying certain taxation against the company's dam at Gregg Shoals, in a suit that once questioned the boundary line between Georgia and South Carolina. The higher court's decision did not involve the boundary line, however, and the judgment was reversed on the technicality that the power company had not been given proper notice regarding the assessment by a board of arbitrators, which assessment was upheld by Judge Pendleton's decision.

Cheaper for Municipalities to Buy Their Energy Supply.—"Judging from statistics, many municipalities in Wisconsin, particularly the smaller ones, that own and operate utilities are finding it more to their advantage to buy electricity for power and lighting purposes than to manufacture it," said H. L. Geisse, secretary of the Wisconsin Railroad Commission, in commenting on an increasing list of cities that have contracted with large private companies to supply them with energy in place of generating it themselves. "It is evident that there is an advantage in purchasing the power, for the reason that the number of places that have switched from local manufacture of current to the purchase of current is rapidly increasing from year to year. In fact, it is not hard to prophesy that within a short time we will have a few large generating plants that will supply current to practically all of the smaller ones."

Maine Company Again Lowers Rates.—For the second time in the last two years the Cumberland County Power & Light Company, Portland, Me., has lowered its domestic rates. The maximum rate has been reduced from 8.5 cents to 8 cents per kilowatt-hour. In announcing the new rates the company said: "While this reduction will show a loss in revenue to the company at the beginning, we hope that we can secure enough additional business to offset this loss before the end of a year. We are endeavoring to place electricity within reach of a larger number of our citizens, and take pride in doing our share toward helping to build up the cities, towns and villages we supply and wish to be a part in every move that will work toward making an improvement in the conditions throughout the territory we serve."

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

PREDICT FURTHER ADVANCE IN INSULATOR PRICES

Owing to Conditions That Now Prevail in Labor Market Manufacturers Are Unable to Adequately Supply Demand

Besides the troubles that beset all those who nowadays purchase metal, the manufacturer of insulators in addition is afflicted with an almost equally bad situation in the pottery field, wherein the labor problem is very serious. On account of the difficulty of getting metal some manufacturers are not soliciting suspension insulator business as actively as they are the pin-type insulator business. On the other hand, buyers are becoming more impatient in their demands for finished insulators.

All sections of the country except the South and the Far West are producing insulators as fast as is now possible. From these sections, however, some manufacturers report good business while others report it only fair. In the mining field it is understood the demand now is 40 per cent to 50 per cent ahead of last year. While the volume of business is large and very satisfactory manufacturing conditions are decidedly unsatisfactory. It is known that one factory, in evidence of the seriousness of present conditions, is now 500,000 suspension insulators and 75,000 high-tension pin-type insulators behind in delivery. Ninety days is absolutely the best delivery that this factory can make or will quote. Conditions are quite similar in other plants, and it is expected in some quarters that deliveries of four months will be quoted in the near future.

Insulator prices have advanced four times in the last year and are still unstable. In spite of these advances, which have aggregated about 30 per cent, still higher prices are in prospect for the not distant future. Labor conditions, more than any other one item, are said to be responsible for this price situation. Because many insulator factories are in that section of the country where the munitions business is most flourishing, mechanics are being continually enticed into the war plants by extraordinary wage offers. Were it not for the shortage of labor the insulator manufacturers say they would not be so far behind in deliveries. They have the plant facilities, generally speaking, to operate at 150 per cent normal capacity. But not many are running at that rate because they cannot satisfactorily man the equipment.

In the central station field is seen a condition which must be met. Light and power companies have delayed purchasing, but there is so little hope of price conditions becoming better for a long time, that the companies have become resigned and are undertaking little by little betterment work and new projects.

METAL PRICES AGAIN ADVANCING

Copper Reaches Thirty Cents and Iron and Steel Are Progressing Upward Steadily

Again the swing of the pendulum of the metal market is felt and prices are advancing. Early this week electrolytic copper was quoted nominally at 29.5 to 30 cents for immediate delivery with December delivery but 0.25 cent lower. This is an advance of 1 cent per pound during the week and several very heavy inquiries at these prices have been received. Holders of the red metal, however, are not particularly eager to sell at these quotations, anticipating as they do to dispose of their holdings at much better prices.

Nor is the spot market alone in this condition. Reports from producers indicate as a conservative estimate that 80 per cent of the copper to be produced during the first quarter of 1917 has been sold, while of that to be produced during the first six months of 1917 from 60 to 70 per cent has been contracted for. Under such a strain the market advanced to 28.75 cents for first quarter electrolytic and 27.75 for first half 1917 electrolytic.

According to reports, brass manufacturers have been the biggest buyers of late.

Pig iron and steel prices are steadily advancing. During the first week in November billets advanced by around $5 a ton. Rods, bars and plates were the same, but shapes advanced about 4 per cent. Black sheets advanced slightly and galvanized sheets from $4.75 to $5. Large buying by manufacturers is reported to be the reason for the advancing market.

CAR SHORTAGE GROWING SERIOUS

Unless Drastic Steps Are Taken Another Freight Tieup Greater Than the Paralysis of the Late Winter May Result

Again a paralysis of freight transportation is threatening the United States, particularly on goods to and from the Eastern seaboard. There was a net shortage of 61,000 cars for the month ended Sept. 30, according to the compilations of the American Railway Association, and for the month of October the shortage was much heavier. Last year at this time there was a net surplus of over 200,000 cars. Of course, the increase in freight will not be so great during the few coming months as it was twelve months ago since factories were working at top speed. Nevertheless to enter the winter with a shortage of freight cars is felt to be very serious. Much that is carried by water in warmer months must now travel by rail. Under these conditions there is every indication that unless some action is taken to force receivers to unload shipments within the minimum of delay, the freight congestion and railroad paralysis that will follow will far exceed the one experienced early in the current year. To help prevent such a condition of general paralysis the electrical manufacturers may do their part by urging customers to unload cars immediately, and by they themselves keeping their tracks as clear as possible.

NEW PRODUCTS TO MEET FOREIGN COMPETITION

There Is No Evidence that American Electrical Manufacturers Are Developing New Ideas for Capturing the Export Markets

Of all of the complaints that are made against American manufacturers individually, and especially electrical manufacturers who seek to enter the export market, none have been so strong as the one charging indifference to local conditions or local markets. Other export nations built lines especially for the export trade. For instance, meters for Uruguay are of a peculiar design. The mechanism is the same but the way of indicating the instrument reading is different from American practice. Russian sockets are not the same as those used in this country. African and Australian practices require goods that are not the same as those used in this country.

Nevertheless, the American manufacturer seems either unwilling to supply the goods the native wants, or else is unable to understand that American goods to enter foreign markets must be of a form that is recognized and is com-

mon. Foreign buyers recognize that American made merchandise is well made, but they feel this disrespect of their wants.

Nor is it evident that the American electrical manufacturer has yet learned this cardinal principle. An investigation made to learn if any new designs were being developed to meet foreign competition after the war ends, disclosed no new products of this nature. American manufacturers apparently will continue to try to obtain a foreign outlet for products identical to those used in this country. On the other hand, it is quite possible that the American manufacturer feels that he is too busy just now with his domestic market to give his attention to building up a foreign trade.

This latter condition has always prevailed in this country. In times of prosperity little or no attention has been paid to exports. When, however, less prosperous times prevailed the American manufacturer has been eager to again develop a foreign trade.

PER CENT PROFIT SMALL

Production Costs Have Increased More Than Prices —Gross Profits Larger Than Ever

Prices of electrical equipment are to-day considerably higher than they were a year ago. Still the manufacturer is making a smaller profit in per cent than he did twelve months ago. Exclusive of wire and cable prices have advanced on the average of 25 per cent, some more and some less. Production costs, however, have increased much more than 25 per cent on the average. Wages probably have gone up least of all the expenses and they have increased about 25 per cent. Copper has doubled in value, and iron has gone up 40 per cent.

Other expenses, however, such as overhead, have decreased in per cent, owing to the volume of business handled. Still, it is not believed that the decrease has been sufficient to offset the increased cost in per cent of labor and materials.

Gross profits are, of course, greater this year than in any previous year. During no previous twelve months have electrical factories been so rushed with work. Never has there been such a difference between production facilities and volume of unfilled orders.

WATT-HOUR MARKET SWAMPED WITH ORDERS

Purchases in Spring for Year's Requirements Prior to Price Advance Keeps Factories Working at Top Speed

Last spring word was sent out by prominent manufacturers of watt-hour meters that an advance in price would be necessary, and that by prompt action buyers could place orders at the lower prices for the succeeding year's requirements, deliveries to be made throughout the year. Central stations were not slow in recognizing the saving to be made, and numbers of them placed their orders for the year's requirements. As a result, the factories found their shops swamped with orders. The orders for 1916-1917 requirements were much larger than for the preceding years. One company reports the 1916 business to be three times that for 1915.

Since last spring prices have advanced on account of heavy production costs. Labor has been very hard to obtain in sufficient quantity, and wages naturally have advanced considerably. Manufacturing materials have also increased in price.

In spite of the fact that practically an entire twelve months' production was ordered last spring, deliveries have not been normal. The principal drawback has been the labor condition referred to.

It is not improbable, however, that many of the central stations which ordered a year's supply in advance last spring will find that next spring a very large number of meters will still be on hand. Should this prove general, then meter manufacturers will find production facilities to spare. The reason for this condition lies in the price of building materials and of copper. It is well known that a vast amount of construction work has been deferred owing to the greatly increased cost of building materials. Also, it is more difficult to persuade a person to have his home wired to-day when he knows that copper costs twice as much as it did last year.

INSULATION MANUFACTURERS REPORT BRISK DEMAND

Firms Making Mica Insulations and Others Making Formed Insulations Both Enjoying Good Business and See Bright Outlook Ahead

Mica insulation manufacturers report business conditions as very good. Some do not attribute the extraordinary volume of business to any particular branch of the industry, while others indicate that activities in motor manufacturing are, in a large measure, responsible for it. Motor manufacturers, as has repeatedly been pointed out in these columns, are and have been for a year, unable to produce sufficient motors to supply the demand.

As to price conditions, the opinion was unanimous that they are at present unstable. Prices have advanced in the past and just how they will move and when they will move in the future is not clear. Raw materials are hard to get, and there seems to be a lively demand on the limited supply of raw mica now in the market.

Deliveries at present are nearly normal in some cases and are said to be generally as good as can be expected under present conditions. Opinion on the state of credits and collections places them between fair and good. Only some firms are attempting to do an export business; the others consider it "too risky."

As to the outlook for the future, a general spirit of optimism prevails. It is expected, however, that the declaration of peace in Europe will materially change prices.

With the makers of molded insulation, business is also good. Orders and inquiries are coming in freely. No one seems inclined to ascribe the great volume of business to any particular branch of the industry, but it is said by some firms that manufacturers of radio and electro-therapeutical apparatus, measuring instruments and telephones are exceedingly good customers.

Prices in all but a few instances have advanced, due to the short hours for labor and to the advance in price of raw material. Even after these increases, prices are not staple in all quarters. Some manufacturers are expecting higher labor rates and unrest among their mechanics when the new railroad employees' eight-hour law goes into effect. They anticipate a somewhat similar action to be taken by every industry, again increasing labor cost, and therefore the prices of their manufactured products.

The supply of raw materials, while generally thought to be somewhat more free than it was early in the year, is still scant. Moreover, raw materials are high priced. It is necessary for the purchasing agents to take long chances on stocking special parts that may be of little or of great value a few months hence. Credits and collections are excellent.

In the export trade, too, conditions are of interest. There have been repeated inquiries from Great Britain, but the English seem to be frightened at American prices, while, on the other hand, those from South America have brought considerable business at prices some of which have been higher than those quoted to Great Britain.

The outlook for the future appears universally bright. While it is believed that the ending of the European war must necessarily have some effect on business, molded insulation manufacturers are looking for a gradual recession rather than a sudden drop. It is expected that the recession, amounting to 15 per cent or 20 per cent of the floodtide of recent months, may continue for but a short period. In fact, in probably less than a year after the cessation of hostilities, when the warring nations have had time to adjust themselves to peace, business, according to some manufacturers, should again revive and continue at its present rate.

Manufacturing and Industrial

Charles G. Atkins, consulting engineer, Chicago, has removed his offices from Room 1353 Monadnock Block to Room 1457 in the same building.

Insulator Factory Doubles in Size.—Owing to the demand for insulators the Electrose Manufacturing Company, Brooklyn, N. Y., is increasing its factory space 100 per cent.

John M. Atkinson, formerly chairman of the Public Service Commission of Missouri, will engage in the general practice of law, specializing in public utility rate, valuation and reorganization cases.

Bound Brook Oil-Less Bearing Company, Bound Brook, N. J., announces the appointment of George Oakley Smalley as first vice-president and general manager of the company, succeeding the late Leigh Stanley Bache.

The Electric Heating Apparatus Company announces its removal from 133-137 East Sixteenth Street, New York, to its new general office and works, 121-123 Sussex Avenue, Newark, N. J. This company is engaged in the manufacture of multiple unit furnaces and heating appliances.

Bosch Service Facilities.—The service system of the Bosch Magneto Company has been augmented recently by the appointment of a number of service stations. These stations have complete sets of special tools and testing apparatus, and each has one or more men trained at the Bosch service schools.

Northern Engineering & Trading Company, Christiania, Norway, is desirous of obtaining for its home office and branch offices in Denmark, Sweden and Russia trade literature of American manufacturers. The company maintains an office in New York City, 117 East Eighteenth Street, in charge of Ingvar Tokstad.

Kelsey, Brewer & Company Dissolved.—The partnership of Kelsey, Brewer & Company has been dissolved by mutual agreement. The business will be continued by Joseph H. Brewer of Grand Rapids, Mich.; John H. Blodgett of Boston, Mass.; Charles McPherson of Grand Rapids, Mich., and Albert E. Pierce of Eau Claire, Wis., who have formed a partnership, under the name of Kelsey, Brewer & Company.

Shinn Manufacturing Company, Inc., 53 West Jackson Boulevard, Chicago, Ill., announces its organization for the purpose of general manufacturing, taking over the manufacturing and sale of Shinn dependable and National flat lines of copper cable lightning conductors. General offices are at Chicago, and factories at Niles, Mich., and Windsor, Canada. The officers of the new organization are as follows: President, W. C. Shinn; vice-president, W. F. Harrah; secretary, L. B. Shinn; treasurer, W. H. Parkin.

National Carbon Company Buys Land for Additional Factory Buildings.—In order to extend its factory facilities the National Carbon Company has purchased 63 1/3 acres of land at 117th Street and Berea Road, Cleveland, on which it will erect buildings that will ultimately involve an expenditure of $1,000,000. The land lies across Berea Road from the present factory and has a frontage on the New York Central Railroad. It cost in the neighborhood of $200,000. It is understood that the improvements will be started at once.

Cutler-Hammer Employees Hold Entertainment.—The seventh annual Halloween entertainment of the employees of the Cutler-Hammer Manufacturing Company was held at the Milwaukee Auditorium on Oct. 21. More than fifty men, employees from the motor controller department, push socket department, magnetic gear shift department, insulating material department, magnetic clutch department and testing departments, took part in the program. The C-H activities committee gave this entertainment and has charge of all similar Cutler-Hammer functions. More than $300 was cleared and this sum will be devoted to pay part of the expenses of the annual Christmas party.

New England Jobbing House Opens Lighting Service Department.—The Pettingell-Andrews Company, Boston, Mass., announces that it has established a special department, the operating activities of which will be devoted entirely to the interests of clients in the planning and development of new, more modern and efficient equipments in commercial and industrial lighting. This department, the company states, places at the disposal of clients the services of a staff of highly trained engineers who have made lighting problems of this nature a life study and stand ready at all times to cooperate in perfecting individual installations for stores, factories, warehouses, office buildings, public buildings, etc.

The Annual Lyon Sample Fair.—Beginning on March 1, 1917, and continuing for fifteen days, the second annual Lyon Sample Fair will be held at Lyon, France. This fair, according to a bulletin of the Department of Commerce, is of importance to the American manufacturers because it offers an exceptional opportunity to advertise American goods in Europe generally and in France in particular. Also, it offers a peculiar opportunity to do business in France at once. A special department has been organized by the American consulate at Lyon to deal with inquiries from manufacturers in the United States. Those who cannot exhibit should send catalogs and other literature for distribution at this fair. If possible the essential points of these catalogs should be translated into French.

A Selling Text-Book for the Lamp Dealer.—"How to Succeed as a Mazda Lamp Merchant" is the title of a useful 160-page book that has just been issued by the National Lamp Works of the General Electric Company, Cleveland, Ohio, compiled from the experience of lamp dealers who have been successful. "Perhaps this is not a 'book' in the ordinary sense," reads the preface. "It is simply a series of guideposts set up for people who prefer to let others make their mistakes for them. Every sentence represents the experience of some other fellow." The lamp merchant's business relations, the setting of a business "bogie," where to sell lamps, facts about lamps, the outstripping of competition by building prestige, helps in selling and advertising tungstens, turnover as a vital factor in successful merchandising—are some of the topics of chapter contributions from the pen of well-known lamp sales specialists.

Larger Quarters for Monitor Controller Company.—The Monitor Controller Company of Baltimore, originators of the "Just Press a Button" system of automatic control for all classes of motor-driven machinery, have moved into larger quarters at 600-616 East Lombard Street. The new factory is about twice the size of that formerly occupied, and extends on East Lombard Street from South Gay to Frederick. When the former factory was first occupied, about five years ago, provision was made for what was considered a very liberal growth of the business. Now, when the lease on the old quarters has still some time to run, it is necessary to provide increased facilities. The new quarters will enable the company to cope with the very rapidly growing demand for its direct and alternating-current controllers, and at the same time provide facilities for the continued development of full automatic control for metal working machinery such as lathes, drills, planers, etc.

NEW YORK METAL MARKET PRICES

	Oct. 31 Selling Prices Bid	Oct. 31 Selling Prices Asked	Nov. 6 Selling Prices Bid	Nov. 6 Selling Prices Asked
Copper	£ s d	£ s d	£ s d	£ s d
London standard spot	124 0 0		124 0 0	
Prime Lake	28.25 to 28.50†		28.50	to 29.00†
Electrolytic	28.50 to 28.75†		29.50	to 30.00†
Casting	27.25 to 27.50†		27.75	to 28.00†
Copper wire base	33.00†		35.25†	
Lead	7.00		7.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	15.00		16.00	
Spelter, spot	10.30 to 10.55†		10.67½ to 10.92½	
Tin, straits	....		42.50	
Aluminum, 98 to 99 per cent.	58.00 to 60.00†		58.00	to 60.00†

OLD METALS

Heavy copper and wire	23.00	to 23.50†	23.00	to 23.50†
Brass, heavy	13.50	to 14.00†	13.50	to 14.00†
Brass, light	10.25	to 10.50†	10.25	to 10.50†
Lead, heavy	5.87½	to 6.00†	5.87½	to 6.00†
Zinc, scrap	6.50	to 6.75†	6.50	to 6.75†

COPPER EXPORTS

Total tons to Nov. 6 3,044

†Nominal.

Corporate and Financial

United Water, Gas & Electric Company, Hutchinson, Kan.—An issue of $972,000 of 5 per cent first and refunding mortgage gold bonds due Sept. 1, 1941, is being offered at 96 and interest.

Great Northern Power Company, Duluth, Minn.—A block of $1,469,000 first mortgage 5 per cent gold bonds due on Feb. 1, 1935, is being offered at 91 and interest, to yield over 5.75 per cent.

Electric Bond & Share Company, New York, N. Y.—Preferred stockholders have been offered the right to subscribe at par for the new issue of $2,000,000 of 6 per cent preferred stock, according to the plan announced in the ELECTRICAL WORLD for Oct. 28, page 384.

United Service Company, Scranton, Pa.—The company has taken possession of the DuBois (Pa.) Electric & Traction Company and has recently acquired the Gettysburg (Pa.) Lighting Company, the Reynoldsville (Pa.) Light & Power Company and the lighting plant at New Oxford, Pa.

American Light & Traction Company, New York, N. Y.—The board of directors at a meeting held on Oct. 3, 1916, declared the regular quarterly cash dividend of 1.5 per cent to holders of preferred stock; a quarterly cash dividend of 2.5 per cent to holders of common stock, and a stock dividend to holders of common stock, at the rate of two and one-half shares of common stock on every 100 shares of common stock outstanding; all payable on Nov. 1, 1916, to stockholders of record at the close of business on Oct. 14, 1916.

Federal Light & Traction Company, New York, N. Y.—New interests have acquired substantial holdings in the stock of the company. As a result a special meeting was called recently, at which Samuel Insull, president of the Commonwealth Edison Company, Chicago; Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, and Calvert Townley, assistant to President E. M. Herr of the Westinghouse company, were elected directors. The retiring directors are R. E. Breed, president of the American Gas & Electric Company; Anson W. Burchard, vice-president of the General Electric Company, and F. L. Dame, who is associated with Harrison Williams.

Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.—In presenting the annual report for the year ended June 30, 1916, the directors felt that an extended account should be given of certain operations, particularly the new development undertaken at Wissota Dam. Concerning this project the directors say in part: "At the beginning of the last fiscal year the company was in possession of large opportunities for water power development on the Chippewa River of Wisconsin and its tributaries. During the year the work of improving one of the most important of these opportunities was undertaken. The development in question is located at a point on the Chippewa River, near the city of Chippewa Falls. It involved the construction of a hydroelectric power station capable of producing 50,000 hp. and involving the expenditure of upward of $2,500,000. Prior to engaging upon the work, the company entered into a contract with the Northern States Power Company of St. Paul, which provided a market for a large part of the available power resultant from the proposed construction. By this action every question of possibilities of profitably marketing the electric product of the new enterprise was satisfactorily answered. The engineering problems involved in construction furnished, therefore, the only elements of speculation at its outset. At the date of this report the complete work at Wissota Dam represented approximately 75 per cent of the total to be done. The transmission line from Wissota to the St. Croix River, the point of delivery to the company's principal customer for the output of Wissota, is completed. Of the machinery to be actuated by the water-power, some is already on the ground, and the remainder is well under way in shops. Nothing so far indicated leads to any other belief than that by Jan. 1, 1917, electric energy will be produced at Wissota Dam for delivery according to contract. A comparative summary of the income and profit and loss accounts of the company for the past and the previous fiscal years shows the following:

Operating revenue	$1,041,260	$1,182,729
Non-operating revenue	14,634	28,204
Total revenue	$1,055,894	$1,210,933
Operating expense	$302,205	$330,635
General expense	133,770	164,978
Taxes	73,805	83,109
Total operating and general expenses and taxes	$509,780	$578,722
Net earnings	$546,114	$632,211
Deduct interest charges	241,682	249,215
Net income	$304,432	$382,996
Deduct preferred stock dividends	126,111	160,085
Profit and loss surplus for the year	$178,321	$222,911

New Utility and Industrial Companies

The Portz Electric Company of Columbus, Ohio, has been incorporated with a capital stock of $10,000 by Adam Portz and others.

The R. & H. Manufacturing Company of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 to deal in electrical supplies. The incorporators are Fred K. Hendershot, L. B. Hendershot, J. G. Rainuette, Leslie G. Rainuette and others.

The Scientific Instrument Company of Atlantic City, N. J., has been incorporated with a capital stock of $5,600 to manufacture and deal in electro-developers. The incorporators are: Andrew Jacoby, John H. Flett and David Altman of Atlantic City, N. J.

The John O'Mara Company of Brooklyn, N. Y., has been incorporated by H. Mayer, S. Bluestone and J. J. O'Mara, 9 Palmetto Street, Brooklyn, N. Y. The company is capitalized at $5,000 and proposes to deal in hardware supplies, gas and electric fixtures, stoves, etc.

Rudolph Schmidt & Company of Rochester, N. Y., has filed articles of incorporation with a capital stock of $30,000 to carry on a business as electricians and opticians. The incorporators are: E. Schmidt, R. L. Schmidt and G. L. Schmidt, 109 Dartmouth Street, Rochester, N. Y.

The American Water Works Construction Company of Atlanta, Ga., has been chartered with a capital stock of $25,000 to do general engineering and construction work, such as building water-works, electric plants, etc. The incorporators are: Edward H. Barnett, W. O. Alston and Daniel G. Fowle.

The Standard Tool & Manufacturing Company of Arlington, N. J., has been incorporated by John Stranberg and Bernard Keating of Arlington, N. J., and Frank Roach of Newark, N. Y. The company is capitalized at $25,000 and proposes to manufacture machinery, construct docks, buildings, gas, electric, telephone plants, etc.

The Central Electric Equipment Company of Albany, N. Y., has been chartered by E. M. and Leo T. Welch, Frederick D. Germain of Albany; Howard and Burr Deitz of Slingerlands. The company is capitalized at $3,000 and proposes to deal in autos and supplies; also to do an electrical contracting and mechanical engineering business.

The Southern Homes Fuel Gas Company of New York, N. Y., has been chartered with a capital stock of $100,000 by F. D. Stoba, E. A. Gingras and G. F. Jebbett, 265 West 122nd Street, New York, N. Y. The company proposes to manufacture and deal in engines, motors, gas-making machinery, storage batteries and steam regulating devices.

Putnam County Electric Company, Granville, Ill.—Sidney Whittaker, George W. Hunt and John G. Pletsch have incorporated the Putnam County Electric Company and have applied to the State Public Utilities Commission of Illinois for permission to take over the property of Sidney Whittaker. This consists of an electric light plant in the city of Granville, Ill., distribution systems in the adjoining cities of Standard and Mark, and transmission lines between the towns. The consideration is said to be $25,000.

The Des Moines (Iowa) Bright Light Company has been chartered with a capital stock of $10,000 to deal in electrical appliances. The officers are George E. Russell of Cherokee, Iowa, president; James L. Anker, vice-president, and Benjamin McPhee, secretary and treasurer.

The Radio Engineering Company of Des Moines, Iowa, has been incorporated with a capital stock of $10,000. The officers are: Walter S. Harris, president; A. Hoyt Taylor, vice-president; W. Marc Frazer, secretary, and Walter S. Harris, treasurer.

The Grand Electric Company of New York, N. Y., has been incorporated with a capital stock of $5,000 by A. Shaftel, M. Janiger and B. Sternick, 11 West 114th Street, New York, N. Y., to deal in electrical appliances, motors, and also an electrical contracting business.

The Williamsburg (Va.) Power Company has been incorporated with a capital stock of $50,000 to construct and operate an electric light and power plant in Williamsburg. The officers are: Julian T. Winfree, president; William M. Mulligan, secretary and treasurer, both of Williamsburg.

The Utilities Contracting Company of Brooklyn, N. Y., has been incorporated by T. J. Gerehart, J. E. and J. Rosenthal, 138 Heyward Street, Brooklyn, N. Y. The company is capitalized at $10,000 and proposes to do a general realty, engineering, construction, electrical, trucking, trading, etc., business.

The Electric Steam Generator Company of Spokane, Wash., has been incorporated by L. B. Williams, I. A. Shorno, Frank Tunis, I. M. Timberman, Charles A. Gram and H. B. Pierce. The company is capitalized at $100,000 and proposes to manufacture a newly patented electric-steam generator.

The Electric Hoist Corporation of Brooklyn, N. Y., has been incorporated with a capital stock of $25,000 by G. Cass, F. M. Alleva, A. A. Schroeder, 2117 East Fourteenth Street, Brooklyn, N. Y. The company proposes to manufacture and deal in machinery, motors, tools, engines, derricks, dredges, scows, etc.

The Electro-Amalgams Corporation of New York, N. Y., has been incorporated with a capital stock of $30,000 by E. O. Towne, H. W. German and B. B. Cromble, 169 West Eightieth Street, New York, N. Y. The company proposes to establish a system for the electro-chemical purification of water and an electro-chemical mining process.

Trade Publications

Reflectors.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared an illustrated leaflet concerning reflectors for industrial lighting.

Circuit Breakers.—An attractive calendar describing I—T—E circuit breakers has been prepared by the Cutter Company of Philadelphia.

Electroliers.—J. D. Bergen Company of Meriden, Conn., has prepared catalog No. 10, illustrating and describing its rich cut-glass electroliers.

Electrical Appliances.—The Hotpoint Electric Heating Company of Ontario, Cal., is distributing a folder announcing a Hotpoint holiday campaign.

Motors.—The Howell Electric Motors Company of Howell, Mich., has distributed its bulletin on polyphase motors, featuring the patented rotor-centering bearings.

Rotary Pumps.—The Goulds Manufacturing Company of Seneca Falls has arranged Bulletin 113, describing its rotary pumps. The text is well prepared and illustrated.

Twist Drills.—"Drill Chips" is the title of a clever booklet brought out by the Cleveland Twist Drill Company of Cleveland. The text is interesting and well illustrated.

Controllers.—Drum-type controllers for railway service are described and illustrated in circular 1571 just issued by the Westinghouse Electric & Manufacturing Company.

Electrical Devices.—Price list No. 32, dated Oct. 1, 1916, regarding "American Beauty" electric heating devices has been published by the American Electrical Heater Company of Detroit.

Electric Fixtures.—"Aladdin" household fixture sets are illustrated and described in a catalog issued by the Fox Electric Corporation, 119 West Forty-second Street, New York City.

Galvanometers.—Bulletin No. 232A, descriptive of a new portable D'Arsonval galvanometer, has been issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa.

Insulators.—Bulletin No. 14, issued by the Electrose Manufacturing Company of Brooklyn, N. Y., has been received. This is descriptive of insulators for use for voltages of 1000 to 1,000,000.

Motors and Generators.—The Fairbanks-Morse Company of Chicago, Ill., has recently published bulletin No. 31, which is descriptive of direct-current type CPB ball-bearing motors and generators.

Induction Motors.—Bulletin No. 211, descriptive of alternating current type H constant-speed, ball-bearing induction motors, has been prepared by the Fairbanks-Morse Company of Chicago, Ill.

Batteries.—Handbook CI regarding the "Chloride Accumulator" for use in 32, 110 and 120-volt isolated lighting and power plants has been issued by the Electric Storage Battery Company of Philadelphia.

Lamp Guards.—A series of well-prepared and illustrated leaflets, circulars and letters have been prepared by W. N. Matthews & Brother, Inc., of St. Louis, Mo., descriptive of its ten-year guaranteed lamp guards.

Reflectors.—The National X-ray Reflector Company of Chicago and New York has prepared four plates describing recent installations. Plate No. 32, banks; Plate No. 33, theaters; Plate No. 45, building exteriors; Plate No. 46, bank screen lighting.

Taps and Dies.—Catalog 37 issued by the Greenfield Tap & Die Corporation of Greenfield, Mass., is a 270-page book descriptive of this company's products. It is well illustrated and contains valuable information for the user of the machine shop tools listed.

Electrical Supplies.—Catalog 11, descriptive of the complete line of the Trumbull Electric Manufacturing Company of Plainville, Conn., has been received. This book of 216 pages is carefully prepared, well illustrated and indexed so that items can be easily found.

Induction Motors.—Bulletin No. 601, descriptive of the Diehl alternating-current polyphase induction motors, has been recently prepared by the Diehl Manufacturing Company of Elizabeth, N. J. The text is well illustrated, showing features of these motors as well as actual installations.

Railway Motors.—No. 232-V railway motor having a rating of 30 kw. at 600 volts is fully described and illustrated in leaflet 3764-A just issued by the Westinghouse Electric & Manufacturing Company at East Pittsburgh. This motor is said to represent the latest development in railway motors of the split-frame type.

Railway Equipments.—The question of standard railway equipments is treated briefly and concisely in circular 1577 just issued by the Westinghouse Electric & Manufacturing Company. This question is becoming of more and more importance to the railway industry, and the information given in this circular is intended to aid in the adoption of certain standards.

Railway Motors.—The No. 101-K railway motor, with a rating of 30 kw. at 600 volts, is described and illustrated in considerable detail in leaflet 3510 recently issued by the Westinghouse Electric & Manufacturing Company. This motor is especially adapted to operating conditions requiring the handling of heavy loads at slow speed without undue draft of current on the generating equipments.

Electric Locomotives.—The Westinghouse Electric & Manufacturing Company has recently prepared a very elaborate and profusely illustrated circular, No. 1516-A, covering electric locomotives for freight haulage. This subject is thoroughly discussed from all angles, including reasons for the adoption of electric locomotives and discussions of freight traffic by electric railways, a detailed description of the equipment used in such work as well as the Interstate Commerce Commission requirements for this service.

New England

BINGHAM, ME.—The Central Maine Power Company is contemplating the construction of a dam at Bingham on the Kennebec River to act as a reservoir and to consist in controlling river. It is also proposed to utilize the power to generate electricity for transmission.

CORINTH, ME.—The Bangor (Me.) Railway & Electric Company has awarded the contract for construction of a new substation in Corinth to W. E. Fish, of Bangor.

MIDDLEBURY, VT.—The Central Power Corporation, recently incorporated with a capital stock of $1,000,000, contemplates developing water rights and power on Middlebury River and its branches, and to construct and operate auxiliary steam plants for generating and distributing electricity in Barre and certain other towns in Addison, Orange and Washington Counties. Charles H. Thompson of Montpelier, and Alexander Gordon of Barre and others are interested.

HAVERHILL, MASS.——The Haverhill Electric Company has applied to the Massachusetts Gas and Electric Light Commissioners for permission to issue 2312 shares of capital stock, par value $100, to be offered to stockholders at $130 per share, amounting to $300,560, the proceeds to be used to pay off floating indebtedness, for new construction and property improvements and equipment.

LUNENBURG, MASS.—The citizens have voted to extend the municipal electric-lighting system to Flat Hill. The cost is estimated at about $3,500.

WALTHAM, MASS.—A committee has been appointed by the Board of Aldermen to make investigations of the general lighting system in connection with making recommendations for improvements to the system.

Middle Atlantic

AKRON, N. Y.—At a special election held recently the proposal to equip the municipal water-works system for electrical operation and approval of a contract with the Genesee Light & Power Company of Batavia for the erection of an electric transmission line through the village of Akron and lighting the streets of the village at an estimated cost of $19,000 was carried.

AMSTERDAM, N. Y.—The local substation of the Adirondack Electric Power Corporation was damaged by fire recently, causing a loss of about $5,300.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 14 for furnishing fuel-oil apparatus, water-tube boilers, electrical cable, cord, wire and elevating gear, frogs and switches, fuses, pipe-threading machines, radio-transmitting sets, voice tubing, etc.

BUFFALO, N. Y.—The Frederick Truscott & Son Company of Buffalo has been awarded contracts for installing electric power and light equipment in the additions to the Children's Hospital, Buffalo General Hospital, and the new pattern shop of Pratt & Letchworth.

BUFFALO, N. Y.—The Erie & Ontario Company of Buffalo has asked the City Council to approve its application to use unappropriated waters of the Niagara River for sanitation, power and navigation purposes. It is proposed to construct a drainage canal connecting Lake Erie and Lake Ontario.

COOPERSTOWN, N. Y.—The Public Service Commission has granted the Southern New York Company of Walton, the Deposit (N. Y.) Electric Company and the Colliers Light, Heat & Power Company of Cooperstown permission to consolidate under the name of the Southern New York Power & Railway Company. The consolidated properties will be largely extended and improved throughout the territory in Oswego, Herkimer, Montgomery, Schoharie and Delaware Counties where they are now operating. Transmission lines will eventually be erected and communities between stations will be served with electricity.

GLENS FALLS, N. Y.—The International Paper Company has awarded a contract to the H. P. Cummings Construction Company of Ware, Mass., for construction of a hydroelectric power plant at Glens Falls.

GLOVERSVILLE, N. Y.—The installation of an ornamental lighting system in the business district is under consideration. Plans submitted by the Fulton County Gas & Electric Company provide for 64 ornamental iron posts mounted with one 600-cp. Mazda lamp.

MINEOLA, N. Y.—Application has been made by the Nassau Light & Power Company to the Public Service Commission for permission to issue $531,000 in capital stock, the proceeds to be used to pay for improvements already made and for further improvements.

RANSOMVILLE, N. Y.—A petition is being circulated for the establishment of a street-lighting district in Ransomville. If approved the Lewiston & Lake Ontario Shore Power Company will install a lighting system, consisting of 30 street lamps.

SPENCER, N. Y.—The Public Service Commission has authorized the Seely Electric Company of Spencer to issue $11,300 in capital stock, the proceeds to be used for improvements to its plant. The company will purchase the boiler house and equipment of the S. Alfred Seely Company for $1,600; a new engine, alternator and exciter, switchboard and accessories will be purchased for $8,000.

ALLENTOWN, PA.—The Public Service Commission has granted the Lehigh Valley Light & Power Company of Allentown permission to take over the Alburtis, Freemansburg, Halcyon, Hellerstown, Myers and Topton Electric Companies.

CHAMBERSBURG, PA. — Preparations are being made by the Cumberland Valley Utilities Company, recently organized to take over the properties at Chambersburg, Shippensburg, Waynesboro and vicinity, and for the installation of electric lighting systems at St. Thomas, Mercersburg, Fayetteville and other municipalities in Franklin County.

CHESTER, PA.—The Beacon Light Company, a subsidiary of the Philadelphia Electric Company, has awarded contract for construction of a six-story, reinforced concrete and steel power house to the Chester Construction & Contracting Company. The cost of the proposed plant is estimated at $2,500,000.

DUQUESNE, PA.—The Duquesne Light Company of Pittsburgh has purchased a site, about 2 miles from Dixmont, on which it proposes to erect a new power station. The company, it is reported, will supply electrical service in the town of Aliquippa.

HAZLETON, PA.—The Louis Roessel Company is contemplating the construction of a new power house at its silk manufacturing plant. W. E. S. Dyer is architect.

JOHNSTOWN, PA.—The Dale Light, Heat & Power Company of Johnstown has filed notice of an issue of $80,000 in bonds, the proceeds to be used for extensions to plant.

PHILADELPHIA, PA.—The contract for the construction of a new power house at the Misercordia Hospital, Fifty-fourth Street and Cedar Avenue, has been awarded to John McShain.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 20 for three ventilating systems, including blowers, electric motors, plenum chambers, ventilators, air ducts and accessories, in buildings Nos. 17, 25 and 26, at the United States Navy Yard, Philadelphia.

PITTSBURGH, PA. — The Duquesne Light Company is erecting a high-tension transmission line to New Brighton, a distance of 32 miles, to supply energy to the Beaver Valley Traction Company.

POTTSTOWN, PA.—The Philadelphia Suburban Gas & Electric Company is contemplating extending its transmission lines across the Schuylkill River to Kenilworth and Cedarville to furnish electrical service in those towns.

SCRANTON, PA.—The United Service Company of Scranton has recently taken over the property of the Du Bois (Pa.) Electric & Traction Company, and has also recently acquired the Gettysburg (Pa.) Lighting Company, the Reynoldsville (Pa.) Light & Power Company and the electric plant at New Oxford.

SUNBURY, PA.—The Public Service Commission has authorized the Northumberland County Gas & Electric Company to make improvements to its local plant.

NEWARK, N. J.—Specifications have been approved by the Council for the installation of new lighting fixtures in the city hospital. H. J. and J. V. King, of Newark, are architects.

NEW BRUNSWICK, N. J.—Sealed bids will be received by the county building committee of the county of Middlesex, at the County Record Building, New Brunswick, N. J., until Nov. 13 for construction of a brick power house and furnishing a pumping and electric-lighting plant for their new county workhouse, located in North Brunswick Township, according to plans and specifications prepared by Alexander Merchant, architect, 363 George Street, New Brunswick, where plans can be seen. Separate bids to be submitted for the two branches of the work.

SPARROWS POINT, MD.—Plans have been prepared for a new electric generating plant and engine room for the Sparrow Point plant of the Bethlehem Steel Company.

LYNCHBURG, VA.—The Lynchburg Traction & Light Company has started work on the installation of a new street-lighting system for the city. The entire overhead wire system as well as the lamps will be new. Under the new contract 710 new arc lamps are to be installed. This does not include viaduct and bridge lighting, or the ornamental lighting system in the business section of Main Street.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 24 for furnishing and installing lighting fixtures in the United States post office at Antigo, Wis.; Arkdelphia, Ark.; Attleboro, Mass.; Brenham, Tex.; Ellensburg, Wash.; Grand Junction, Col.; Greenwich, Conn.; Humboldt, Tex.; Norton, Va.; Ridgway, Pa., and Valley City, N. D., in accordance with drawings and specifications, copies of which may be obtained at the above office. For details see proposal columns.

North Central

CHEBOYGAN, MICH.—The Cheboygan Electric Light & Power Company is contemplating increasing its development on Black River and extending its service to Petoskey and Harbor Springs.

DETROIT, MICH.—The Detroit United Railway Company is contemplating improvements to the boiler equipment in one of its power plants, which will include the installation of six Stirling boilers and forced draft stokers and the erection of a large brick smokestack. Owing to the increasing demand for energy the company contemplates the purchase of 3500 kw. from the Detroit Edison Company in addition to its present contract of 10,500 kw.

WHITEHALL, MICH.—Preliminary arrangements have been made for the organization of the White River Power & Light Company, which will be capitalized at $500,000. The company has constructed a dam at Ferry and has erected an electric transmission line from Ferry to Hesperia; other lines will be built to Montague and Whitehall, where a 24-hr. service will be provided.

CENTERBURG, OHIO.—The Columbus Railway & Light Company is contemplating extending its transmission lines to Centerburg to supply energy to the Centerburg Electric Company. The lines of the Columbus company already extend as far as Westerville and it is now proposed to erect lines to Centerburg, via Galena, Sunbury, Johnstown and Croton.

CINCINNATI, OHIO.—The City Council has authorized an issue of $14,000 in bonds to provide funds to equip the new Hopple Street Viaduct with electric lamps and trolley poles. Bids will soon be asked on specifications prepared by Frank H. Raschig, city engineer.

HAMILTON, OHIO.—Ordinances have been passed by the City Council authorizing extensions and improvements to the municipal electric plant, involving an expenditure of $5,700.

SALEM, OHIO.—Ground has been broken for the foundation of the new power plant to be erected by the Buckeye Engine Company.

WILLIAMSPORT, OHIO.—The Circleville (Ohio) Light & Power Company has been granted a 25-year franchise to install an electric-light and power system in Williamsport.

LEXINGTON, KY. — The American Metallic Packing Company of Lexington is contemplating the purchase of three return tubular boilers, 72 in. by 18 ft., 150 lb. working pressure, and a 500-hp. steam turbine engine directly connected to generator.

DANA, IND.—The Town Trustees have authorized the sale of the municipal electric-light plant to the Clinton (Ind.) Light & Power Company, at $6,700. The local plant will be used until the transmission lines of the company can be extended to Dana.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company has applied to the Public Service Commission for permission to increase its capital stock from

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

$100,000 to $250,000. The compauy is planning to increase the output of its ice factory.

SEYMOUR, IND.—The Interstate Public Service Company has secured contracts to supply electricity in the towns of Brownstown, Vallonia and Medora from its Seymour plant. A 24-hr. service will be furnished.

SHELDON, IND.—Steps have been taken to organize a company to establish an electric-light plant in Sheldon. C. F. True is interested.

SPICELAND, IND.—The town of Spiceland is contemplating the installation of a municipal electric-light plant and waterworks, for which $5,000 in bonds have been authorized.

BENTON, ILL.—Preparations have been completed, it is reported, by the St. Louis & Southern Illinois Interurban System of Benton, for the construction of an electric railway, 81 miles in length. The cost of the project, including power plant, is estimated at about $3,000,000. The company, it is said, will soon be in the market for equipment.

BLOOMINGTON, ILL. — Improvements to the municipal electric-light plant, including the purchase of a new generator and other equipment, to cost about $15.000, is under consideration by the City Council.

EUREKA, ILL.—Plans have been submitted by the Caldwell Engineering Company for the development of the Rome View drainage and levee district in Woodford County. The proposed project calls for the construction of an electrically operated plant, equipped with two 30-in. pumps driven by 250-hp. motors. The cost is estimated at about $338,000.

FAIRBURY, ILL.—A committee has been appointed by the City Council to investigate the proposition of establishing a municpal electric-light plant.

GENOA, ILL.—The Woodstock & Sycamore Traction Company, which operates a steam road between Sycamore, Genoa and Marengo, 26 miles long, contemplates equipping the railroad for electrical operation. J. P. Mason, of Genoa, is general manager.

HILLSBORO, ILL.—The Saline County Electric Company of Hillsboro has purchased the property of the Duquoin (Ill.) Utility Company and the Pinckeyville (Ill.) Utility Company. The company, it is reported, is negotiating for the purchase of the public utilities in Sparta, Eldorado, Chester and Nashville.

JOLIET, ILL.—Plans are being considered by the City Council for equipping the main station of the water-works system for electrical operation.

MURPHYSBORO, ILL.—The Murphysboro Water Works, Electric & Gas Light Company has awarded the contract for construction of its new power station to L. W. Peters. The new plant will be located immediately west of the old power house at the foot of Walnut Street and will have about three times the generating capacity of the present plant.

TAMAROA, ILL.—The Village Board has granted the Saline Electric Company a 25-year franchise to supply electricity to Tamaroa and a ten-year contract for street-lighting, providing for 25 lamps.

BALSAM LAKE, WIS.—An electric-lighting system it is reported, will be installed by Dahlberg & Sons, in Balsam Lake.

BOSCOBEL, WIS.—Plans have been prepared by the City Council for improvements to the municipal street-lighting system.

GRESHAM, WIS.—The Gresham Electric Light & Power Company has been granted a franchise to construct and operate an electric-light plant in Gresham.

MERRILL, WIS.—The installation of a new street-lighting system in Merrill is under consideration.

MILWAUKEE, WIS.—Plans are being considered by Superintendent Pinney of buildings and grounds for the installation of an indirect lighting system in the city hall next year.

NEW LISBON, WIS.—Bids will be received by J. H. Crandall, clerk of joint school district of the city of New Lisbon and town of Lisbon, until Nov. 20, for installing a steam heating plant, plumbing and electric wiring in a school building now in course of construction. Plans and specifications may be obtained from Chandler & Park architects, Racine, Wis., upon deposit of $5.

OSHKOSH, WIS.—The Oshkosh Gas Light Company is contemplating an addition to its power house or the erection of a new building.

RACINE, WIS.—Preparations are being made by the Racine Auto Tire Company for the construction of a new plant, including factory buildings, warehouses, power plant, etc., to cost about $100,000.

SHAWANO, WIS.—Plans are being considered to increase the output of the municipal electric-light plant, including the installation of new boilers and generator.

STEVENS POINT, WIS.—The property of the Stevens Point Lighting Company, including electric and gas plants, has been purchased by the Wisconsin Valley Electric Company of Wausau, which will extend its transmission lines to this city.

ARLINGTON, MINN.—Plans are being considered for improvements to the municipal electric-lighting plant and extensions to transmission lines.

BIRD ISLAND, MINN.—The Renville County Electric Company of Bird Island is extending its transmission line from Olivia to Renville, through Danube. This line will connect with the transmission line of the Minnesota Valley Power Company at Renville, from which source the Renville company will secure its power. Equipment has been purchased and the line is nearly completed. W. B. Foshay is assistant secretary and treasurer.

MIDDLE RIVER, MINN.—The Middle River Light & Power Company has been granted a franchise to install an electric-light plant in the Middle River.

BUFFALO, IOWA.—The City Council is considering granting a franchise for the installation of an electric-lighting system in Buffalo.

CARROLL, IOWA.—The Carroll Light & Heat Company is planning the erection of an electric transmission line from Manning to Templeton, a distance of 22 miles. The company is also considering the purchase of a 500-kva. generating unit.

CEDAR RAPIDS, IOWA.—The Iowa Railway & Light Company is contemplating the erection of 75 miles of 33,000-volt, three-phase, 60-cycle transmission line from Coon Rapids to Herndon, Panora, Guthrie Centre, Manlo and Adair.

COUNCIL BLUFFS, IOWA.—Plans have been submitted to the Citizens Gas & Electric Company of Council Bluffs by committees of the City Council and the Chamber of Commerce for the installation of a new street-lighting system. It is proposed to replace the old flaming arc lamps with new ornamental standards, mounted with two tungsten lamps of 400 cp. each, replacing the 38 arc lamps now in use with 166 tungsten lamps.

ELMA, IOWA.—The Consumers Electric Company has been granted a franchise to erect and operate an electric transmission line between Elma and Riceville for a period of 25 years. A. L. Dodd, of Elma, is president of the company.

LONE ROCK, IOWA.—The Lone Rock Electric Light Company is contemplating the construction of cement block power house.

MARSHALLTOWN, IOWA.—The Iowa Railway & Light Company of Cedar Rapids has applied to the Board of Supervisors of Marshal County for a franchise to erect transmission lines over the highways of Marshal County.

SCRANTON, IOWA.—The property of the Scranton-Glidden Electric Company of Scranton has been purchased by the Iowa Light & Power Company. The local company secures energy from the municipal electric plant at Glidden.

SIOUX CITY, IOWA.—The Sioux City Gas & Electric Company is planning to extend its transmission lines to Jackson, Neb., and to Whiting, Iowa. Extensions to street-lighting system are contemplated, consisting of the erection of 800 electroliers, each carrying five 100-watt lamp clusters.

ASH GROVE, MO.—Plans, it is reported, are being prepared for the construction of an electric power plant in Ash Grove. The plant of the Ash Grove Milling & Electric Company was recently sold under a foreclosure.

ELDORADO SPRINGS, MO.—Within the next 60 days the Missouri Valley Light & Power Company expects to purchase a condenser to be used in the ice plant and also a brine pump. The company is also finishing a 72-in. by 36-ft. smoke stack. J. M. Atkinson is resident manager.

HUNTSVILLE, MO.—The Public Service Commission has granted the Huntsville Light & Power Company permission to purchase the local electric-light plant, owned by T. F. Fulkerson, at $16,000. The commission also granted the company permission to issue $25,000 in capital stock.

KANSAS CITY, MO.—The Northeast Improvement Association has decided to start a campaign to substitute the gas lamps now in use for 250-watt-tungsten lamps, and if possible to have all arc lamps in this district changed to tungsten lamps.

ST. LOUIS, MO.—Plans have been prepared for the construction of a building for Central Dispensary and Department of Public Welfare, to cost about $125,000. The building will be equipped with two automatic electric elevators; heat and light will be supplied from the central plants of the City Hospital. Bids will be opened about Dec. 1. P. J. Markmann, engineer, is in charge of design and construction.

WEBB CITY, MO.—The Southwest Missouri Electric Railroad Company, which operates an electric suburban railway between Carthage, Webb City, Joplin, Mo. and Galena, Kan., contemplates extending its line from the latter terminal to Baxter Springs, Kan., a distance of about 9 miles. The cost is estimated at about $300,000. Later, it is said, the railway will be extended from Baxter Springs to Commerce, Picher and Cardin and other new zinc mining towns, which have recently sprung up in Oklahoma.

BUSHNELL, S. D.—A franchise has been granted to the Dakota Light & Power Company of Flandreau to supply electrical service in Bushnell.

BEATRICE, NEB.—At an election held recently the proposal to issue $25,000 in bonds for improvements to the municipal electric-light plant was defeated.

CRETE, NEB.—Plans are being prepared for the construction of a power plant in Crete for the Fairmount Creamery Company, Twelfth and Jones Streets, Omaha, to cost about $8.000. Harry Lawrie, Paxton Building, Omaha, is architect.

DUNBAR, NEB.—The city of Dunbar is considering the installation of an electric-light plant. Wilbur W. Anness and C. C. West are interested.

YORK, NEB.—Plans are being prepared by the Public Service Corporation for construction of power house, to cost about $20,000.

ARGONIA, KAN.—Bids will be received by Elmer Troxell, city clerk, Argonia, Kan., until Nov. 15 for two 100-gal. per minute motor-driven deep-well pumps, one 50,000-gal. tank, one 90-ft. tower, machinery, etc. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

HIAWATHA, KAN.—Plans are being considered for the installation of a new street-lighting system in Hiawatha next spring.

INDEPENDENCE, KAN.—The city of Independence City, we are informed, does not contemplate, at present, calling a bond election for a municipal electric plant.

KANSAS CITY, KAN.—The County Commissioners have granted the Kansas City Light & Power Company permission to supply electricity anywhere in Wyandotte County for lamps outside of the city limits of Kansas City, Kan. Energy for motors cannot be served within 2 miles of the city limits. The company asked for the privilege of supplying electricity anywhere in the county. The company, it is said, contemplated erecting a power plant on the Missouri River in the county. The modification of the permit, it is reported, has resulted in the company seeking a site elsewhere.

Southern States

BURLINGTON, N. C.—The Piedmont Railway & Electric Company of Burlington contemplates the erection of an electric transmission line to Elon College and Gibsonville, 8 miles long; a transmision line, 2 miles long, to Hopedale Mills is now under construction. George W. Hatch is general superintendent.

CHARLOTTE, N. C.—The Southern Public Utilities Company has awarded contract for improvements to the hydroelectric plant at Portman Shoals to W. W. Anderson, S. C. The work includes raising bulkhead above power house, from 8 to 9 ft., and deepening tail race 3 ft. The cost is estimated at $30,000.

CHESNEE, S. C.—C. S. Ballard has the contract for the construction of an electric-light plant in Chesnee. George Blackwell is owner and manager.

EATONTON, GA.—Steps have been taken by local business men for the installation of an ornamental lighting system in the business section.

METTER, GA.—The contract for equipment for the proposed municipal electric-light plant has been awarded to Fairbanks, Morse & Company, of Chicago, Ill The cost of the plant is estimated at $8,000. About 50 hp. will be developed. W. M. Crook, of Macon, is engineer.

SAVANNAH, GA.—The Savannah Electric Company contemplates a 4-mile extension to its Millhaven street car line. H. C. Foss is local manager.

TIFTON, GA.—The Tifton Ice & Power Company is reported to be contemplating the construction of a new building.

BRADENTOWN, FLA.—The Manatee Electric Company of Bradentown is installing a new generating unit, consisting of a 250-kva. General Electric alternator and Skinner uniflow engine. P. R. Chambers is manager.

OKEECHOBEE, FLA.—A franchise has been granted to the Southern Utilities Company of Jacksonville to construct and operate an electric-light and power system in Okeechobee.

ARLINGTON, TENN.—The installation of an electric-light plant in Arlington is under consideration. Bids, it is understood, have been received for the proposed plant.

MEMPHIS, TENN.—The city of Memphis has engaged Fred Ballard, of Cleveland, Ohio, consulting engineer, to supervise the construction of the proposed municipal electric-light plant, the cost of which is estimated at $2,980,150, which includes the following work: Generating station, $292,000; substation, garages, etc., $156,000; underground transmission and distributing systems, $725,000; overhead transmission and distribution systems, $120,000; other equipment, $125,000; material and supplies, $100,000; working capital, $40,000, and organization expenses, $20,000. Bonds to the amount of $1,500,000 will be sold on Nov. 14 to provide funds for initial expenditures, and the Legislature will be asked to authorize $1,500,000 additional next January.

NASHVILLE, TENN.—Plans are being considered for the construction of a power house annex to the St. Thomas Hospital, to cost with equipment about $22,000.

OBION, TENN.—The municipal electric-light plant was recently damaged by fire, causing a loss of about $1,500. The town will be without electric service for about two months.

BESSEMER, ALA.—Arrangements have been made with the Alabama Power Company whereby the citizens of Hueytown will secure electrical service. Energy will be secured from the transmission line of the company now being erected from Bessemer to Jasper.

COLUMBUS, MISS.—A petition has been presented to the City Council asking that the proposal to issue $50,000 in bonds for the construction of a municipal electric-light plant be submitted to the voters.

ARKANSAS CITY, ARK.—Preparations are being made by the Lambe & Denmark Light & Water Company to install an electric-light plant and water-works system in Arkansas City. A 100-kw. electric generating unit and oil engine will be installed. An ice plant will probably be built later.

CLARKSVILLE, ARK.—The construction of an electric railway from Clarksville to Hagerville, Silex and other points is under consideration. For further information address Railroad Committee, Clarksville.

GILLETT, ARK.—The town of Gillett has granted the Stuttgart (Ark.) Public Service Company a 50-year franchise to supply electrical and water service here. The company will construct a plant in Gillett.

HEBER SPRINGS, ARK.—The Arkansas Hydro-Electric Company of Little Rock has purchased the property of the Heber Springs Light & Power Company. Extensive improvements will be made to the system, including the installation of new engine and generators. This movement, it said, is one of the preliminary steps toward the construction of the proposed hydro-electric plant on the Red River, just north of Heber Springs, at a cost of about $2,000,000. Surveys have been made and plans drawn for the proposed dam. The company proposes to supply electricity to a number of towns in this section, including Pangburn, Searcy, Judsonia, Bald Knob, Beebe and Lonoke.

BARTLESVILLE, OKLA.—The W. K. Palmer Company, 919 Baltimore Avenue, Kansas City, Mo., is in the market for material for the construction of an electric interurban railway, including rails, ties, all track and overhead material, cars, substation equipment for the Oklahoma & Northern Traction Company, for proposed railway to be built from Bartlesville, east to Miami, Okla., and to Joplin, Mo., with extension from Miami, Okla., to Columbus, Kan., and Baxter Springs, Mo., about 130 miles.

DURANT, OKLA.—Plans are being prepared by the North American Light & Power Company for the construction of an electric-light and ice storage plant, to cost about $18,000. W. A. Boehr, 122 South Michigan Avenue, Chicago, Ill., is president of the company.

PRAGUE, OKLA.—The Council is considering calling an election to submit to the voters a proposal to issue bonds to provide funds for improvements to the municipal electric-light plant.

AUSTIN, TEX.—The City Commission contemplates extending the municipal ornamental lighting system to a number of additional residential streets.

BERTRAM, TEX.—The installation of an electric light and power plant in Bertram is under consideration. Elias Allen is interested.

CUMBY, TEX.—The local electric-light plant owned by B. and C. B. English has been purchased by George Holland.

DALLAS, TEX.—As soon as franchise matters, now pending, are settled the Southern Traction Company, it is announced, will proceed with its plans for extending its interurban electric railway from Waco south to Austin, a distance of about 100 miles.

DE KALB, TEX.—Investigations are being made in De Kalb by Louis H. Fuller of Houston with a view of establishing an electric-light and power plant.

GALVESTON, TEX.—The City Commission is considering extending the street-lighting system to the alleys in the business district.

GONZALES, TEX.—The Gaudalaupe River Power Company will soon complete the construction of a large dam across the Gaudalaupe River, near Gonzales, and will proceed with the installation of a hydro-electric plant.

LAMESA, TEX.—The Lamesa Light & Power Company, recently incorporated with a capital stock of $5,000, proposes to construct and operate an electric-light plant here. E. F. Cox, R. B. Red and N. C. Lindsey are interested.

LA PRYOR, TEX.—The installation of an electric plant in La Pryor is under consideration. R. L. Couser and W. L. Tittsworth of La Pryor are interested.

MISSION, TEX.—The capital stock of the Mission Light & Water Company has been increased from $20,000 to $40,000, the proceeds to be used for improvements to plant.

TERRELL, TEX.—The sale of the municipal electric-light plant to the Texas Power & Light Company, for $55,000, will be submitted to a referendum vote of the taxpayers for approval.

Pacific States

ARLINGTON, WASH.—The County Commissioners have granted the Washington Coast Utilities Company a franchise to erect electric transmission lines along the county road from Norman through Florence to Stanwood and along the highlands road. Silvana to Stanwood, together with all roads intersecting and 3 miles each side. This line will be an extension from Arlington. The cost is estimated at $15,000. The company recently took over the holdings of the Jim Creek Water, Light & Power Company of Arlington.

DAVENPORT, WASH.—The Washington Water Power Company of Spokane has applied to the County Commissioners for a 50-year franchise to erect and operate electric transmission lines along certain roads in Lincoln County.

PASCO, WASH.—The Pacific Power & Light Company has applied to the County Commissioners for a franchise to erect and maintain electric transmission lines in Franklin County.

PE ELL, WASH.—W. F. Shepherd has purchased the interest of L. A. Webb in the Central Light & Manufacturing Company of Pe Ell and contemplates improvements to the plant. Application has been made to the Council for a franchise to supply the city with street lamps and electricity for residence lighting.

SEATTLE, WASH.—A bill has been introduced in the City Council authorizing the Board of Public Works to let a contract for the construction of a hydroelectric plant, including transmission lines, as an extension of the existing city power and light plant, the cost not to exceed $3,000,000.

EASTSIDE, ORE.—Tht City Council has granted the Oregon Power Company of Eugene a franchise to supply electricity in Eastside for a period of 25 years. The service will be supplied from the company's central station on Coos Bay.

KLAMATH FALLS, ORE.—A special election will be held Nov. 14 to submit to the voters the proposal to grant a franchise to the Reno (Nev.) Power Company to supply electricity in Klamath Falls.

AGNEW, CAL.—The committee on membership has submitted to the board of managers of the Agnew State Hospital recommendations for special appropriations from the Legislature for improvements, among which is included a lighting system.

INDEPENDENCE, CAL.—Application has been filed by the Southern Sierras Power Company of Denver, Col., for a franchise to erect transmission lines along the roads and highways of Inyo County.

LOS ANGELES, CAL.—The construction of a hydroelectric power plant on the Ventura River in connection with an irrigation project is under consideration by the Sespe Light Power Company, Security Building, Los Angeles. The project as yet has not been financed.

WILLOWS, CAL.—W. F. Fowler of Willows has applied to the State Water Commission for permission to appropriate 250 cu. ft. per second of water from the Sacramento River for rice culture on 14,000 acres. The water will be raised by electrically-driven pumps to the main canal, which is given as 10 miles in length. The cost of the proposed work is estimated at $180,000.

BOISE, IDAHO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 24 for the installatioln of a new conduit and wiring and alterations in heating system in the United States assay office at Boise, Idaho.

SALT LAKE CITY, UTAH.—Plans are under way by the State Street Improvement Association for lighting State Street with luminous arc lamps similar to those in use on Main Street from South Temple to Fifth South Street.

DOUGLAS, ARIZ.—The cost of installing ornamental lamps in the G Avenue and Tenth Street districts is estimated at about $12,500.

GARDENVILLE, NEV.—The installation of an electric plant in Gardenville is under consideration. L. Ruhenstroth is interested in the project

Canada

LETHBRIDGE, ALTA.—At an election held recently the ratepayers passed a by-law appropriating $17,000 to pay for extensions for additions to the electric system.

RAYMOND, ALTA.—Arrangements have been completed for the removal of the present power plant at the Knight Sugar Factory to the Ellison Mill. The plant is to be completely overhauled. It proposed to furnish a continuous service.

PENTICTON, B. C.—The City Council has recently authorized the purchase of 12 5-amp. watt-hour meters and two 10-amp. watt-hour meters. The purchase of a new Diesel engine, to cost about $25,000, is also under consideration by the Council.

FORT WILLIAM, ONT.—The City Council is negotiating with the Hydro-Electric Power Commission with reference to further electrical development. This development, it is expected, will be at Dog Lake Falls. An additional supply of 10,000 hp., it is estimated, will be required within the next year or two.

HAMILTON, ONT.—The construction of an electric incline railway, to cost about $200,000, is under consideration by the City Council and Hydro-Electric Power Commission.

SPRINGFIELD, ONT.—The ratepayers have passed a by-law authorizing an agreement with the Ontario Hydro-Electric Power Commission for electrical service in Springfield.

ST. ALEXIS, QUE.—The Saguenay Light & Power Company is building a new power house, dam and penstock at St. Alexis. Two generating units (directly connected) will be installed. The company will supply electricity in the town of Ha Ha Bay for lamps and motors.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Nov. 14 for furnishing hardware for four-family concrete lieutenants' quarters, one motor-driven shaper, steel sash frames and operating devices for school buildings and mill work for lieutenants' quarters, under proposal No. 1096.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal Commission, Washington, D. C., until Nov. 24 for furnishing cold-rolled steel, portable blower, rubber valves, gaskets, electric cable and wire, electric fixtures, bell transformers, watt-hour meters, electrical fittings, etc. Blanks and general information relating to this circular (No. 1097) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

14,208. ELECTRICAL SYSTEM; Richard Varley, Englewood, N. J. Reissued Oct. 31, 1916. Means for exploding the charges in the cylinders of an internal combustion engine.

1,202,788. ELECTRICAL MEASURING INSTRUMENT; William M. Bradshaw and Walter G. Mylius, Wilkinsburg, Pa. App. filed May 28, 1913. Double ratchet type of watt-hour meter.

1,202,793. TROLLEY-WIRE SUPPORT; James Bryan, Pittsburgh, Pa. App. filed July 21, 1913. Prevent lateral deflection of the conductor supports under pressure of the trolley wheel, particularly when rounding curves.

1,202,818. METAL-CARBON BRUSH; Henry R. Edgecomb, Edgewood Park, Pa. App. filed Dec. 26, 1913. Combines the lubricating properties of a carbon brush and a degree of conductivity which approaches that of a metal brush.

1,202,837. ELECTRIC FURNACE; Ingenuin Hechenbleikner, Charlotte, N. C. App. filed Feb. 7, 1914. Utilize the heat of the furnace gases to uniformly preheat the charge.

1,202,841. ELECTRIC MOTOR OR GENERATOR; Edward A. Halbleib, Rochester, N. Y. App. filed June 14, 1915. Provide for the protection of the current leads by which connection is made with the windings.

1,202,846. ELECTRIC IRON; Thomas D. Hurley, Green Island, N. Y. App. filed June 2, 1916. Means for attaching the terminal plug to electrically connect the conductor to the iron.

1,202,870. TWIN SIGNAL ELECTRIC LAMP; Jeremiah M. Meekins, Baltimore, Md. App. filed Aug. 31, 1915. Adapted to be carried in the rear of the automobile for the purpose of indicating to a machine following the fact that the automobile carrying the signal will change the direction of travel or is coming to a stop.

1,202,880. ELECTRICALLY CONTROLLED MOTOR; Charles I. Murdock, Marshall, Mich., and Herman R. Graf, Jackson, Mich. App. filed Feb. 27, 1915. Improved means to electrically control motors.

1,202,885. INSULATOR PIN; Charles L. Peirce, Jr., Pittsburgh, Pa. App. filed May 17, 1916. To support heavy insulators used in high-voltage line work.

1,202,895. MACHINE-OILER; George M. Rogers, Chicago, Ill. App. filed Feb. 29, 1916. Improvements in oilers for applying lubricating oil to bearings or other machine elements.

1,202,923. ELECTRICAL CONNECTING DEVICE; Samuel Trood, Edgewood Park, Pa. App. filed March 1, 1913. Employed for sad irons, electric heaters and the like.

1,202,925. AUTOMATIC RECORDING SYSTEM FOR RADIO RADIO TIME-SIGNALS; Frank D. Urie, Elgin, Ill. App. filed Dec. 19, 1914. Relates to the receiving, recording and comparing of radio signals.

1,202,952. CONTROLLING SYSTEM; Edgar W. Adams, Hampstead, London, England. App. filed July 28, 1915. For controlling or indicating the relative speeds or difference in speed between the feed mechanisms of two machines.

1,202,957. ELECTRICAL LIQUID-HEATING DEVICE; Eck Baughn, North Yakima, Wash. App. filed Feb. 17, 1916. Provide an electrical heating element of cylindrical form which is adapted to be vertically disposed within a closed receptacle.

1,202,973. TALKING-MACHINE; Patrick B. Delany, South Orange, N. J. App. filed May 14, 1915. Improve the tone and enunciation of talking machines.

1,202,976. ANTIFREEZING APPARATUS; John H. Derby, New York, N. Y. App. filed Dec. 22, 1914. Prevent the freezing of the water in a tank such as is used on top of buildings.

1,202,996. PORTABLE ELECTRIC-LAMP DRY BATTERY; James Shanks Hamilton, London, England. App. filed Feb. 5, 1915. Each battery unit having exposed contact pieces.

1,203,004. ELECTRIC IRON; Witt Juniper, Berwyn, Ill. App. filed Oct. 30, 1915. Can readily be taken apart and again properly assembled.

1,203,064. TRANSMITTING APPARATUS FOR WIRELESS TELEGRAPH AND TELEPHONE SYSTEM; Frederick G. Simpson, Seattle, Wash. App. filed Nov. 16, 1915. Provides electrical apparatus, including an antenna, electric circuits, and electric generator for supplying a direct current of electricity.

1,203,088. START AND STOP DEVICE FOR TALKING-MACHINES; Clinton E. Woods, Bridgeport, Conn. App. filed Sept. 8, 1913. Means for starting and stopping the operation of the parts.

Record of Electrical Patents

Notes on United States Patents issued on Oct. 31, 1916.

1,203,123. RAILWAY SIGNALING; Charles H. Lay, Brooklyn, N. Y. App. filed Aug. 27, 1913. Railway signaling for stretches of single track.

1,203,138. ELECTRICALLY DRIVEN PERCUSSIVE TOOL; Leo Schuler, Lichterfelde, Germany. App. filed May 22, 1915. Combination of a mechanical percussive tool with an electro-motor of special type.

1,203,146. SYSTEM OF VEHICLE CONTROL; Paul J. Simmen, Indianapolis, Ind. App. filed Sept. 24, 1913. Train despatching and signaling systems.

1,203,166. SEMI-AUTOMATIC TELEPHONE SYSTEM; Bernard D. Willis, Chicago, Ill. App. filed June 27, 1914. Means for permitting an operator to supervise a long distance or toll connection.

1,203,030. MEANS FOR REMOVING ELECTRICITY FROM PAPER; Pietro Martucci, Philadelphia, Pa. App. filed Aug. 16, 1915. Attachment for printing presses which is adapted to collect static electricity in the paper.

1,203,045. TERMINAL FITTING FOR ELECTRIC CONDUITS; James C. Phelps, Springfield, Mass. App. filed April 11, 1914. Conduit is closed by means of a cap composed of insulating material.

1,203,049. ELECTRIC SIGN; William Recke, New York, N. Y. App. filed June 5, 1914. Produce a moving picture similar to those produced by the cinematograph.

1,203,125. PROTECTIVE DEVICE FOR ELECTRIC HEATERS; Claude C. Nuckols, Albany, New York. App. filed Oct. 3, 1914. Relates to the protection of an electric heater against excessive temperatures.

1,203,190. RECORDING AND REPRODUCTION OF PULSATIONS OR VARIATIONS IN SOUNDS AND OTHER PHENOMENA; Charles Edgar Fritts, New York, N. Y. App. filed Oct. 22, 1880. Records variations or pulsations in sounds, light, or electrical currents, in a permanent or tangible form, and reproducing the same.

1,203,172. APPARATUS FOR MEASURING OR RECORDING OSCILLATIONS, IMPULSES AND THE LIKE; Alexander Behm, Kiel, Germany. App. filed April 24, 1915. A series of members, preferably rod or bar shaped, are used.

1,203,179. ELECTRICAL SNOW-MELTING HEATER; Jesse A. Bowles, Spokane, Wash. App. filed April 1, 1915. Disposed in a manner to melt the snow and deliver the water to the gutter.

1,203,230. REGULATING APPARATUS; Gisbert Mertelmeyer and Herman Koester, Waterbury, Conn. App. filed April 28, 1915. Provide substantial and positive contact making means.

1,203,239. PAY-STATION FOR TELEPHONE SYSTEMS; George E. Mueller, La Grange, Ill. App. filed Feb. 25, 1915. Without ground connections wherein the deposit of a coin establishes a direct current path.

1,203,266. ALTERNATING-ELECTRIC-CURRENT RECTIFIER; Frederick W. Reeves, Pittsburgh, Pa. App. filed April 30, 1914. Comprises a rectifier formed of plural sets of unitary contacts.

1,203,276. ELECTRIC FURNACE; Ernest Kilburn Scott, Belvedere, England. App. filed Feb. 25, 1916. Furnace for the fixation of nitrogen from the atmosphere.

1,203,279. DRY CELL; George Louis Tarver, Oakland, Cal. App. filed Jan. 4, 1915. Will not deteriorate rapidly.

1,203,287. ELECTRICAL-SWITCH MECHANISM; Mathew J. Weber, Columbus, Ohio. App. filed May 15, 1915. Automatically controlling the operation of the actuating motor of a pump employed for storing water in a tank or reservoir.

1,203,297. ELECTROMAGNETIC VIBRATOR; Charles H. Adams, Muskegon Heights, Mich. App. filed Feb. 18, 1916. Improve, simplify and cheapen the cost of construction of devices of this character.

1,203,307. FREQUENCY-MEASURING INSTRUMENT; William H. Bristil, Waterbury, and Manfried J. Johnson, Naugatuck, Conn. App. filed May 3, 1915. Susceptible to slight changes of frequency.

1,203,215. ELECTRODE; Clarence E. McCollam, Emporia, Kan. App. filed July 20, 1914. Graphite will be protected to a certain extent by means of the metallic support or body which carries the core.

1,203,316. OIL FUSE; Louis W. Downes, Providence, R. I. App. filed July 17, 1912. Adapted to serve as a primary and junction cut-out on high tension polyphase circuits.

1,203,325. TELEPHONE RELAY OR REPEATER; Elwood Grissinger, Buffalo, N. Y. App. filed April 27, 1910. Exceptional sensitiveness which will magnify the electric waves to an unusual degree.

1,203,326. TELEPHONE RELAY OR REPEATER; Elwood Grissinger, Buffalo, N. Y. App. filed May 19, 1911. Avoid the effects of resonance.

1,203,336. TELEPHONE SYSTEM; Edward E. Hinrichsen, East Orange, N. J. App. filed. Connections are to be established between subscribers stations terminating in central offices widely separated.

1,203,343. INSULATING DEVICE; Dale C. Hughes, Cleveland, Ohio. App. filed March 9, 1915. Relates to electric incandescent lamps.

1,203,347. DYNAMO-ELECTRIC MACHINE; Louis J. Hunt, of Sandycroft, Wales. App. filed Dec. 10, 1915. Can be started and run up about to the speed for synchronous working against a load.

1,203,358. ELECTRIC-SWITCH DEVICE; Charles J. Klein, Milwaukee, Wis. App. filed Sept. 25, 1911. Adapted to make and break an electric circuit with quick snap action.

1,203,400. ELECTRIC WELDING-MACHINE; Robert C. Pierce, Cincinnati, Ohio. App. filed May 22, 1916. Means which is automatically operable to close a welding circuit.

1,203,406. HEATER; Harry E. Redeker, Rupert, Idaho. App. filed March 27, 1916. Adapted for laboratory use.

1,203,407. TELEPHONE-EXCHANGE SYSTEM; Arthur E. Reinke of Dulwich, London, England. App. filed April 26, 1916. Improved arrangement of circuit and apparatus at an operator's position.

1,203,415. ATTACHMENT-PLUG; Howard R. Sargent, Schenectady, N. Y. App. filed, Dec. 10, 1914. For use with devices of the separable plug type.

1,203,495. VACUUM-TUBE; William D. Cooldige, Schenectady, N. Y. App. filed May 9, 1913. Vacuum tubes and tubes operated for the purpose of producing Roentgen or X-rays.

1,203,416. ALTERNATING-CURRENT GENERATOR; Paul Sauvage, Paris, France. App. filed Nov. 6, 1912. Appiying an additional inductance to the circuit of the rotor.

1,203,420. ALARM-SIGNAL; Joseph Siddall and William H. Siddall, of Kearney, N. J. App. filed Sept. 15, 1914. Provision of a single device.

1,203,427. ARC-LAMP; Reginald G. Standerwick, Lynn, Mass. App. filed July 18, 1913. Novel form of mechanism by which the arch is established.

1,203,433. ARC-POSITIONING DEVICE; Johann Suchy, Frankfort-Bockenheim, Germany. App. filed June 6, 1913. Improvement in a device of this character.

1,203,462. RAILWAY-TRAFFIC-CONTROLLING APPARATUS; Howard S. Beakes, Wilkinsburg, Pa. App. filed Jan. 14, 1914. Electromagnetic apparatus for controlling railway traffic controlling devices.

1,203,463. ELECTROMAGNETIC DEVICE; Howard S. Beakes, Wilkinsburg, Pa. App. filed June 14, 1914. Electromagnetic relays.

1,203,468. DYNAMO-ELECTRIC MACHINE; Sven R .Bergman, Lynn, Mass. App. filed Oct. 26, 1914. Improve the arrangement of the compensating winding in a compensated direct-current dynamo-electric machine.

1,203,502. TELEPHONE-EXCHANGE SYSTEM; Gerald Deaken, San Francisco, Cal. App. filed Aug. 19, 1912. Provide a private branch exchange system.

1,203,540. HIGH-TENSION AND TELEPHONE LINE CONSTRUCTION; Alfred Lewis, Harrington, Raleigh, N. C. App. filed Nov. 6, 1915. Improved method of transposing the telephone line.

1,203,552. AUTOMATIC MECHANISM FOR CONTROLLING ELECTRIC CUT-OUTS; Maxwell R. Berry, Mentor, Ohio. App. filed June 19, 1913. Adapted for use in connection with the charging of batteries.

1,203,556. FAULTY-CABLE LOCALIZER; Archibald Davis, Schenectady, N. Y. App. filed May 31, 1912. Localizing of faults developed on transmission lines.

1,203,560. TIMER AND DISTRIBUTOR; Frederick C. Hersee, Boston, Mass. App. filed July 30, 1915. Simple and inexpensive construction.